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THE HAMILTON SURFACE PLANER.

We present herewith illustrations of a new surface planer, manufactured by the enterprising firm of Bentel, Margedant & Co., of Hamilton, Ohio, a concern which has gained an enviable reputation for the multiplicity as well as the value of the improved machines numbered among its recent products. Two views, end, Fig. 1, and side, Fig. 2, of the device are given, from which its uses will be readily recognized; while its symmetrical form and compact construction will commend it to the practical mechanic.

There are two planing tables, located respectively above and below the cylinder, both of which are adjustable. The upper table is made in two sections to plane above the cylinder, and the lower table or bed serves for thicknessing from five or six inches, if desired, down to one sixteenth of an inch below the cylinder.

In front of the knives the table rests on inclines, and can, by a hand screw shown in the engravings, be charged from a one sixty-fourth to one and a half inches below the cutting line. The back table remains for planing out of wind, etc, at the extreme hight of the cutting line. A triangular cutter head of a peculiar form is provided; and although the knives are straight, similar to those generally used, they make a drawing cut, thereby insuring a smooth surface. The machine, thus arranged, can be used for planing out of wind, smoothing, squaring, making a glue joint, beveling, cornering, and tapering. Among other advantages claimed for this tool is that the material to be planed out of wind does not need to be leveled, fastened, and run back and forward before the cut is taken; for, since it rests on a level adjustable table before the cutter cylinder will operate upon it, the planed part glides upon the back table as soon as it passes the cutter cylinder. The tool, therefore, planes economically, not cutting away any more than is necessary to secure a smooth surface out of wind. After the work is planed out of wind, it is in the right position to be operated upon by the cutting cylinder to plane it to the required thickness (below the cylinder), requiring no re handling to other machines used for this purpose only. Very short, narrow, and thin material can be planed out of wind by passing it over the cutter cylinder. Circular, oval, and square framed stuff, without regard to the running of the grain, can be passed over the cutter cylinder, planed, and finished.

Fig. 2 shows the machine arranged for planing boards or timber to the required thickness. The upper table, back of the knives, is swung back and brought forward by the hand screw. This part of the table is so constructed that it forms on the lower side a bonnet to direct the upright flying shavings toward the table in front of the cutter head, from which they are blown by the wind created by the revolving cutter head.

The work done above the cylinder is easily fed toward the knives by hand; while the feeding toward the cylinder, below the cutter head, is performed by geared feed rollers, which can be started or stopped by means of a tightening pulley connected with the feed lever. The latter is held in its position by a spring. The feed of the machine can be changed from fast to slow, or *vice versâ*, to suit for hard or soft wood. An adjustable pressure bar, roller scraper, and a gage admit of the lower table being accurately set for any thickness of cut.

The machine is covered by several patents which have been secured through the Scientific American Patent Agency. The manufacturers, to whom further inquiries may be directed, as above, make several sizes and kinds of the tool, from 24 to 16 inches.

The right to manufacture the planer in the Eastern and Pacific States is, we are informed, open to purchasers.

We see, by the late report of the judges of the Cincinnati Industrial Exposition, that the merits of this machine won for it a first premium. Judging from samples of remarkably thin planing and other work, performed on the apparatus and sent for our examination, there is no question but that the distinction was well deserved.

Fig. 1

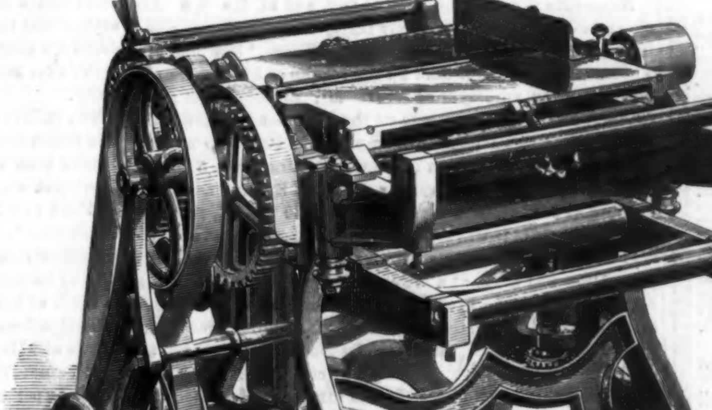

Fig. 2

THE HAMILTON SURFACE PLANER.

Utilization of Tin Waste.

The process includes the following operations: Boiling the waste with water acidulated with hydrochloric and nitric acid, until the tin is completely dissolved. To 2,200 pounds of waste containing 5 to 6 per cent of tin, 660 lbs. of crude hydrochloric acid and 66 lbs. of crude nitric acid are used, with water enough to cover four fifths of the heap. The operation is carried on in tanks of wood or brick, 9·84 feet cube, lined with a composition of 2 parts of sand and 1 part of melted sulphur, and heated by steam. The action lasts from thirty to forty-five minutes. The liquid is then run off, the scrap iron washed, and the washings used in treating the next lot. The tin is precipitated in a spongy state by means of scrap zinc, 70 parts of which serve for 100 of tin. The precipitated mass is washed, and at once dissolved in hydrochloric acid. There remains a mass composed of chloride of lead and oxide of tin; this is mixed with double its weight of coke, and heated in a zinc furnace. Chloride of tin distils over, and metallic lead remains. The iron scrap, freed from tin, can be used in the manufacture of copperas, or in metallurgical operations. The process shows a profit.—*M. Künzel*

Spontaneous Combustion in Hay.

There are doubtless many farmers who have experienced sudden and destructive conflagrations in their hay lofts, which could not be ascribed to any exterior agency. Barns have been known to burst into flame, almost without warning, save perhaps a significant odor, for a few days previously, around the places where the hay was stored, and a summer's harvest is swept away in as many minutes as it has taken days to gather it. These unexpected conflagrations are generally accredited to tramps who have made the hay loft their sleeping resort, but it is now asserted that such calamities are frequently due to the spontaneous combustion of the hay, a circumstance theoretically quite possible, but rarely considered. Abbé Moigno, in *Les Mondes*, gives the following as the theory of the phenomenon: Hay, when piled damp and in too large masses, ferments and turns dark. In decomposing, sufficient heat is developed to be insupportable when the hand is thrust into the mass, and vapors begin to be emitted. When the water is almost entirely evaporated, the decomposition continues, and the hay becomes carbonized little by little; and then the charred portion, like peat, peat cinders mixed with charcoal, sulphurous pyrites and lignite, etc., becomes a kind of pyrophorus, by virtue of its great porosity and of the large quantity of matter exposed to high oxidation. Under the influence of air in large amount, this charcoal becomes concentrated on the surface to such a degree that the mass reaches a temperature which results in its bursting into flames.

The preventives for this danger are care that the hay in the lofts is kept perfectly dry, that it is well packed, and that it is stored in small heaps rather than in large masses.

The Preservation of Wood.

A new work, exhaustively treating the above topic, has recently appeared in France from the pen of Maxime Paulet, a quite eminent chemist. The author advocates especially the use of sulphate of copper and creosoted oil, according to the circumstances under which the wood is employed. Sulphate of copper has a poisonous action upon the animal and vegetable parasites which appear at the beginning of organic decomposition. In treating wood which is to be buried in the earth or submerged in fresh water, the solution should be applied in excess, since the effect of moisture is slowly to dissolve the salt. Sea water acts in this manner so rapidly that sulphate of copper should not be employed for piles or similar marine structures. In wood soaked with the salt solution, a portion of the latter unites closely with the ligneous tissue, and another part, in excess, remains free. This last, first dissolved by the exterior liquids, slowly retards the removal of that combined with the wood; but the combined portion itself, though more stable, does not entirely escape subtraction, accelerated or retarded according to the rapidity of renewal of the dissolving liquid.

On the other hand, for wood destined for aerial structures, the quantity of solution should be diminished in order to prevent the mechanical effect of intervascular crystallizations.

Regarding creosoted oil, M. Paulet states that the tarry and carbolic compounds are much preferable to the metallic salts for wood exposed to sea water, because the naphthaline, aniline, and notably the carbolic acid exercise an antiseptic action, coagulating the albumen and thus destroying both the circulation of the sap and also that in the organic parasites. It is pointed out, however, that these substances render the wood inflammable, while the metallic salts have just the contrary effect.

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CHEAP WORKMEN MAKE DEAR WORK.

It is a common complaint, among those who have paid but superficial attention to the relations of work and wages, that high wages in this country make it very hard, if not quite impossible, for our farmers and manufacturers to compete successfully with the cheap labor of other countries. Such complainers fail to comprehend the economic paradox that the cost of labor affords no criterion of the cost of work. Of course there are limits both ways. Labor must not be so cheap that the laborer cannot subsist on the proceeds of his toil, nor so dear that the product is swallowed up in wages. Within these limits, especially where machinery is involved, the economic law is universal; the cost of production, roughly speaking, varies inversely as the wages paid.

This fact comes out very strongly in the special report of Commissioner Wells to Congress in 1868, wherein the relation of work to wages is discussed in minute detail. As a rule the productiveness of the laborer increases with the increase of his pay, and generally at a more rapid rate; and —though modified by other conditions—the economy in production increases accordingly. Taking the puddling of iron as the representative process of the iron trade, Mr. Wells found the average price of labor per day for puddlers was from $1.80 to $1.88 in Staffordshire, $1.38 in France, and from $1.14 to $1.25 in Belgium. The average price of merchant bar iron was $32.50 in England, $35 in Belgium, and $40 in France.

In an address read before a meeting of the ironmasters of the north of England, Mr. Lowthian Bell gave the results of his investigations as to the cost of smelting pig iron in several countries of Europe. Everywhere cheap workmen were associated with dear work. It required forty-two workmen in a French establishment to carry out the same amount of work which twenty-five men were able to do in English factories. With labor twenty per cent cheaper, the cost of producing pig iron in France was $5 to $6 more per tun than at Cleveland.

In Germany, as in France, though the nominal rates of wages were still lower, the actual cost of work was greater than in England. Thus in Westphalia, where labor was twenty-five per cent less than in England, the cost of smelting a tun of iron was $3.75 more than on the Tees.

The same contrast of cheap labor and dear work was exhibited in the report of Mr. Redgrave on the condition of the textile industries in England. Where labor is cheap, the number of hands required to perform a given amount of work more than offsets the advantage in individual wages. In France, one person is employed on the average to fourteen spindles; in Russia one to twenty-eight; in Prussia one to thirty-seven; in Great Britain one to seventy-four, and not unfrequently mules containing 2,200 spindles are managed by one minder and two assistants. Wages were less in Germany and the hours of labor longer, yet the weight of work turned off was less than would be produced by the same machinery in England, with much fewer operatives. In Russia the inefficiency of the operatives as compared with those of England was still more strikingly manifest. Their wages hour for hour were less than one fourth the amount earned in England; yet the productive power of the English operatives throws the advantage greatly in their favor.

The same condition of things is noticed by Mr. Wells, who shows that, while female labor in the cotton manufacture is paid from $3 to 3.75 a week in Great Britain, from $1.67 to $2.30 in France, Belgium, and Germany, and from 56 cents to 70 cents in Russia, the one thing most dreaded by continental manufacturers everywhere is British competition.

In the carrying-out of his railway and other contracts in every quarter of the globe, the late Mr. Brassey had occasion to employ great numbers of laborers of almost every nationality, at widely different rates of daily wages; yet it was found to be the almost invariable rule that the cost of executing a given amount of work was everywhere much the same. If anything, the advantage in cheapness lay where labor was dearest. Thus the wages paid in England were higher than in any other country; yet bridges, viaducts, tunnels, and all works of art on railways were executed there more cheaply than in any other part of the world. Where labor was plentiful and very cheap, as in Italy or India, simple earth works might be erected at a cheaper rate than in England; but this advantage could not more than make up for the greater cost of the more difficult work.

Numerous illustrations of this fact, and of the law that cheap labor does not necessarily imply cheap work, are given in the interesting volume "Work and Wages," in which Mr. Thomas Brassey, M.P., sums up the results of his father's experience as an employer of labor. Mr. Brassey's first great contract on the continent was on the Paris and Rouen Railway. About 10,000 men were employed, 4,000 of them being Englishmen. The French laborers, working from 5 A. M. to 7 P. M., were paid 60 cents a day; the English navy, beginning at 6 A. M. and leaving off at 5.30 P. M., received $1.25 a day; yet it was found on comparing the cost of adjacent cuttings, in precisely similar circumstances, that the excavation was made at a lower cost per cubic yard by the English than by the French. In the same quarry, at Bonnieres, Frenchmen, Irishmen, and Englishmen were employed side by side, receiving respectively 60 cents, 80 cents, and $1.20 a day. The high priced Englishman was the most profitable workman of the three.

The Dieppe Railway was executed principally by native labor. The French earned from 50 cents to 60 cents a day; when doing piece work, their earnings advanced to 70 cents. A large number of Belgians, somewhat familiar with railway work, were employed and earned 90 cents a day. The English were considered to be worth $1. Ten years later, when the Caen line was constructed, Englishmen were still employed for tipping and plate laying, and on difficult work on deep rock cutting. Their wages were $1 a day as before, while the usual earnings of the French laborers ranged from 55 cents to 70 cents. The English were employed by experienced sub-contractors directly interested in the closest possible reduction of expenditure. Similarly on the Grand Trunk Railway, in Canada, where a large number of French Canadians were employed at 84 cents a day, English navvies were paid from $1.25 to $1.50 a day, and did the greatest amount of work for their money. Extending the investigation to Mr. Brassey's other contracts in France, Italy, Austria, Switzerland, Spain, Germany, Belgium, and Holland, the approximate uniformity of cost for railway work is exhibited in all cases, notwithstanding great differences in rates of daily wages. So, too, in India. On the Delhi and Umritzer Railway, it was found that, mile for mile, the cost was about the same as in England, although the cost of labor, estimated by its 8 cents to 12 cents a day, was marvelously low. Each laborer did his money's worth, and no more. Skilled labor was scarce and high, and in the absence of experienced sub-contractors the cost of supervision was very great, averaging twenty per cent on the entire outlay.

In Southeastern Europe the same state of things prevailed. Unskilled labor was cheap; but in proportion as skill and manual dexterity were required, the difference in the cost of engineering work disappeared. So too in Italy, in the Mauritius, and elsewhere.

But, it may be objected, in all these examples weak men were pitted against strong men, unskilled against skilled labor; there is nothing paradoxical in the assertion that one hearty, well trained, and well fed workman may accomplish more than two or three untrained and ill fed men, costing each one half or one third as much for daily wages.

The objection may be well taken, but it fails to meet cases like the following, given by Mr. Brassey to show that it is quite possible that work may be more cheaply executed by the same workmen, notwithstanding that their wages have highly increased. At the commencement of the North Devon Railway, the laborers received 48 cents a day. During the progress of the work their wages were raised to 60 cents and 72 cents a day. Nevertheless it was found that the work was executed more cheaply when the men were earning the higher rate of wages than when they were paid the lower. Again, in carrying out a part of the Metropolitan Drainage Works in London, the wages of the bricklayers were gradually raised from $1.50 to $2.50 a day; yet it was found that the brickwork was constructed at a cheaper rate per cubic yard after the price was raised than before.

An indirect way of raising wages is to reduce the hours of labor. The evidence is very strong to prove that, with the same men, such advances in the cost of labor do not necessarily increase the cost of work. Indeed it may be said to be the universal rule that beyond ten hours a day the production diminishes as the time increases. With proper diligence, eight hours are enough for a man to do all he is capable of doing daily, with profit to himself and his employer.

THE RELATION OF ALCOHOL TO PHYSICAL STRENGTH

A correspondent asks: (1) Is there not a clashing of authorities in regard to the relation of alcohol to physical strength, as indicated in our recent article on alcohol, food, and force? (2) Whose experiments were therein referred to? (3) How it is possible for a dose of alcohol to increase one's working power, if, as Todd and Bowman state, "the use of alcoholic stimulants retards digestion by coagulating the pepsin of the gastric juice, thereby interfering with its action?" He adds that he does not find in his text books any authority for the position that alcohol is a force producer.

There is a serious clashing to be observed among current opinions in regard to the action of alcohol in the human system, due very largely to the fact that the effects of alcohol vary immensely with the dose, but more perhaps to the tendency of men to come to decided conclusions from one-sided or insufficient evidence, and to hold to such conclusions in spite of every evidence to the contrary.

Regarding authority in the only sense admissible in Science—that is, as the overwhelming weight, not of human testimony, but of facts, critically determined—we cannot say that the alleged clashing is at all serious. The physiological action of alcohol has been determined with as close an approximation to accuracy, probably, as that of any other substance; and while it is never possible to speak with absolute certainty in such matters, we are justified by fact in saying that the grounds for regarding alcohol as a force producer are quite as substantial as those on which we rest our belief that beef, or bread, or any other food is a force producer.

The failure of our correspondent's text books to recognize this result of recent investigations is due very likely to their having been written before the investigations were made. The latest work of eminence in this field—Pavy's "Treatise on Food and Dietetics, Physiologically and Therapeutically Considered"—gives a very good discussion of the *role* of alcohol within the organism, and admits that, up to the time of its publication, the probabilities were, on the whole, in favor of the belief that alcohol is a force-producing food. Investigations still more recently published, notably by Drs. Anstie and Dupré, carry the discussion to the point of practical demonstration, as we have shown in another column.

The experiments, about which our correspondent inquires, were those narrated by Dr. Hammond in the address then under review.

As for the quotation from the works of Todd and Bowman, the facts would seem to prove it perfectly correct, with the addition of the first two letters of the alphabet. It is not the use but the abuse of alcoholic stimulants which has the effect described, as every drunkard's stomach shown after a debauch. In excess alcohol arrests digestion, as it arrests all the other bodily functions. In excess it is a poison, a very dangerous narcotic poison. Nevertheless in proper doses, properly administered, its use has quite the contrary effect. It facilitates digestion, and is otherwise strikingly beneficial. Its indiscriminate use, however, is always and everywhere to be deplored, since only the few are able to use it without abusing it and themselves at the same time.

Because a little at the proper time is good, too many people are apt to infer that a great deal at any time must be better. It is the logical weakness, so happily hit off in Æsop's fable, of the old woman with her hen. Because with one measure of barley the hen laid an egg a day, the thrifty dame reasoned that two measures of barley would make her lay two eggs a day. But they did'nt. The hen simply got fat, and quit laying altogether.

As with alcohol, so with tobacco, so with articles of food like tea, coffee, spices and the rest, so with common necessaries like pure air, cold water, exercise, sleep, pleasure, there are ill balanced people who are never able to discriminate between wholesome use and excess. In time, with the spread of real knowledge, with increasing mental and moral culture and the general elevation of the race, such weaknesses may be outgrown. Till then they must be borne with. To attempt their repression by force is more likely to be mischievous than beneficial, more likely to hinder than help the real advancement of society.

THE LABOR PROSPECTS FOR THE WINTER.

The condition of the labor market in this city is such as to warrant the apprehension of serious trouble among the working classes during the coming winter. Thousands are already clamoring for work. So far from being better than during the darkest days of the panic, the laborers are certainly worse off; and for this gloomy and stagnant state of affairs no definite and certain reason can be assigned.

The New York *World* has investigated this subject very carefully, and the long detailed report which appears in the columns of that journal bears out by actual figures the sinister opinions above given. In rough numbers, there are 30,000 ordinary laborers in this city, on whose work the existence of an aggregate of 150,000 people depends. To determine how large a proportion of this part of the population is idle, recourse has been had to the sources of employment of the greatest numbers, beginning with the city itself. The employees in the municipal service, it appears, have fallen off fully one third; or in other words, 2,000 men, out of the aggregate formerly employed, are out of work. The pay rolls of the Fourth Avenue Underground Railway improvement, by reason of the approaching completion of that work, have been reduced by about the same number; and further examination shows that the ratio of reduction in these two largest sources holds in the cases of smaller operations. Building is stagnant, and but few improvements are being made on lot property; contractors are hampered for funds, owing to the difficulty in raising security, and the

disagreements among the heads of the city government have exercised no small influence in the cessation of small jobs, which employed men by the fifties and hundreds. Taking, then, the ratio of decrease as above noted, and applying it to minor operations, a total of ten thousand men are shown to be out of employ—fully one third of the unskilled laboring population. These are the day laborers, who work, by the score or more, under contractors.

Turning next to the manufactories, we find a class of men who are not connected with the industry as pursuers of the same. They are not mechanics, nor do they fulfil such special functions as the teamsters or porters. They are mere workers, using their muscles at whatever job they are set to perform. Of these 8,000 are idle, for, from the 7,624 establishments about New York, they were the first to be discharged, and so added to the roll of the unskilled unemployed.

From careful investigation it further appears that, on each able-bodied man of the class of society to which these people belong, no less than four persons are dependent. Hence there has been added to the pauper population not merely 18,000 men, but five times that total, or 90,000 souls, and this in November. Compare this aggregate with that of February of the present year—the closing month of winter, when the drain upon the public and private charities is always greatest. Then the total was 80,000; now, at the opening of winter, the figures are 10,000 higher. With regard to wages, in all departments of skilled labor and in all factories the standard has been maintained, with a few isolated exceptions. In coarse and unskilled labor, the reverse is the case. Up to the panic, the usual rates were $2 per day, or $12 per week; at the present time, very few contractors are paying over $1.50 per day. The Italian laborers are getting but $1.25; and railroad contractors in adjoining States are paying that sum, and picking men beside. The comparison between this state of affairs and that of fourteen months ago is a striking one. The pay roll then was: 39,000 laborers at $2, $60,000; 8,000 laborers employed by factories, etc., $16,000; total, $76,000. The pay roll now is 4,000 laborers on city work a. $1.75, 7,000; 16,000 laborers on private enterprise at $1.50, $24 000: total, 31,000. Difference between 1873 and 1874, 45,000. Average share then to each man, $2; now, 67 cents.

It is a fact that the necessaries of life are not a whit less costly now than they were a year ago, so far as the poor man is concerned. The wholesale dealer buys his goods in gross, perhaps, cheaper; but the retailer, with lessening sales to contend with, has no reason to reduce his prices. In rent, a week's wages generally pays for one month; but this relation was adjusted before wages were cut down, so that, to provide shelter for himself and family, the working man pays not twenty-five per cent of his earnings, but fully thirty-one per cent. Coal is dearer than a year ago; if it remains at ruling rates, and counting the consumption in each family of five persons at seven pailfuls per week, fifteen per cent of wages after the rent is paid must be devoted to its purchase; and thus we might continue through the necessaries of life, showing that not merely is utter pauperism staring the unemployed in the face, but even those who look to their day's work for their day's living are menaced with privations and suffering.

One result of this condition is beginning to be apparent in the diminution of immigrants from Europe, and the remarkable increase in steerage passengers leaving this country, avowedly to seek labor in England. Five hundred souls left this port in an Inman steamer a week or two ago, and on one Saturday 2 000 working people sailed for Great Britain, Germany, and France. This is a bad showing, and raises questions relative to the existing tariff and the national finances, which the coming Congress must take into very serious consideration. The immediate relief is in the hands of the charitable. Public institutions are destined to be taxed far beyond their capabilities, and private charity will be called upon within the next six months as never, we think, before. Provision for meeting the outcry for food should begin at once, not delayed until the sad tales of starvation and misery fill the police reports.

It is, moreover, a serious question for capitalists and moneyed institutions to reflect upon, whether they would not serve their own ends of gain best at this time by giving these thousands of idle men the means of helping themselves. It is certain that a large number of deserving poor are, within a few months, to be thrown as a charge upon the city and county. They must be supported, and that in idleness, since, as we have already said, municipal employment offers no opening whatever. Would it not be wise for some of our great moneyed institutions to put out some of their money in aid of desirable local enterprises which will give the workmen employment? We can think of no better example than the case of the Broadway Underground Railway. The road is a direct continuation down town of the tracks of the splendid Underground Railway on Fourth avenue, and the approaching completion of the latter marks not only the feasibility and advantages of such a route within corporate limits, but also suggests the present as the best period for proceeding with the work. The plans of the route are complete, are approved by the best engineers, legislative sanction has been accorded to the project, and nothing remains but the acquisition of capital sufficient to initiate operations. A source of labor will thus be opened during the winter for eight or ten thousand men, and forty thousand people, nearly half of the total number of unemployed, will be furnished with a means of sustenance. As an investment, a first mortgage on a line through the very heart of the city, none better exists. In fine, it would be difficult to conceive of any other project now extant, capable of offering three such great benefits as work to the unemployed, relief to a population earnestly seeking a means of rapid transit, and a safe investment for capital contributed to its promotion.

THE SENSATION OF PAIN IN THE LOWER ANIMALS.

Does the insect, which we thoughtlessly crush under foot, suffer as much pain as we should were we similarly destroyed? It is generally conceded that the proper answer to the question is in the negative; and in fact it would seem much more in accordance with the wisdom displayed throughout the creation of animated nature, that those beings which from their very essentials are subject to wholesale destruction should be spared the pangs incident to the throes of dissolution. No one, except perhaps that most refined of humanitarians who had scruples about drinking water on account of the sufferings he might cause to the animalculæ therein, supposes that any real sensation of agony is experienced by the zoöphyte which we tear from the rock, or by the oyster as we cut it from its shell; but there are many who contemplate the sport of the angler with horror, and who see, in the writhings of the worm on his hook or in the struggles of his finny victim, all the tortures of human mutilation. Where then, at what particular class of being, is the dividing line to be drawn? Are only radiates and mollusks apathetic to dismemberment, or do they also experience sensation, and how far in the ascending scale does the insensibility to pain extend in its decreasing ratio?

It seems to us, and we have no doubt biological fact will bear us out in the view, that the accidental influences of cultivation, of breed, of education in human beings, and also of differences in delicacy of nervous organization, play an important part in determining the degree of suffering. It is well known that a savage will bear pain, not merely in absolute stoicism but apparently unmindfully, which if inflicted on a refined and cultivated individual would produce death or syncope. And this is not merely confined to the barbarian but extends through all grades of society. Physicians state that the sufferings of childbirth are as nothing to the squaw, or to the woman who constantly performs coarse manual labor, when compared with those of the delicate females of our upper classes. The same general rule applies to the lower animals; a finely bred horse winces under a lash that the dray brute would not notice, and the trained hound will yelp at a blow of which a street cur would think nothing. With this distinction in varieties of species before us on one hand, and the fact that both reason and general belief point to the insensibility of lower animals on the other, we are brought to the consideration of an interesting argument, raised by Dr. Crosby of this city, in defence of the practice of vivisection. It is advanced, as a generally received proposition, that the sense of pain is designed for the self preservation of all animals, and further that each is endowed with this sense to an extent only sufficient to ensure the result. That is, in other words, that an insect, for example, has a sufficient sense of suffering to keep him from walking on a hot coal; but if we threw him into the fire, his agony would be comparatively nothing as compared to that of some higher animal in whom the sense of pain is implanted for a greater and more complicated variety of purposes.

It is very difficult, almost impossible, to judge of the existence of pain in an animal by its mere physical contortion. A human being under the influence of ether, during an operation, often writhes and screams as if in great torture, and yet nothing is felt; similarly people in convulsions show every external sign of suffering, and yet, beyond mere muscular soreness due to exertion, none is present. Nor is the cry a proof of pain, for, as Dr. Crosby says, a pig will yell just as lustily, if he be merely held as he will under the infliction of a severe wound. We may judge, however, with greater security, from coincident actions on the part of the creature, as to whether suffering is or is not present. If a man, for example, while undergoing a surgical operation, should, as in a case we once saw, coolly assist the surgeon, and complacently munch an apple while the knife was penetrating his flesh, ordinary reason would lead us to the belief that his assertion that "it did not hurt" was true, and this even did dumbness prevent his stating the fact. If such be true in the one case, and in that of the animal which we know to be most acutely sensible, then it is logically true in the instances of lower orders which we are sure possess sensibility in a less degree; and hence if a horse, as in one of the cases cited by Dr. Crosby, have a fore leg shot off in battle, and thirty-six hours afterward be found quietly grazing, although the stump is horribly mutilated, then it is reasonably certain that the pain is not proportionate to the lesion, if indeed present in any degree whatever.

It is well known that animals often inflict on themselves injuries which apparently must cause suffering, and yet every indication proves the same to be absent. Rabbits have torn themselves free from traps, and been found feeding *minus* two legs. Rats when pressed by hunger will eat their own tails. We have seen pigs, after their throats have been cut, cease their cries and attempt to eat, and it is said that the same animals when stuck unawares often pay no apparent attention to the wound. It is curious also to notice that rabbits and rats, which can support themselves even if their locomotive process be injured, will bite off their feet if caught in traps, but that a carnivorous animal like the fox will never do so, for, once unable to run, he would starve to death. In the first case there appears to be no sense of pain to prevent the action; in the second, the sense certainly exists.

Again, crabs and lobsters drop their claws when frightened, and seemed unhurt. There is a little lizard in Sicily, which, when suddenly alarmed by the blow of a cane on the rock near to it, will break off from its tail and scuttle away, running into obstacles in its path, acting very like a ship without a rudder. Sir Humphrey Davy came to the conclusion that in fishes the sensation of pain was very trifling, and the view seems proved when it is considered how infinitesimal the number of fishes which arrive at maturity is, compared to the myriads of eggs deposited.

A wasp will eat after it is cut in two; so will a dragon fly when impaled; and that the insects should suffer to any degree seems on its face impossible, particularly if the millions and millions which the birds eat be thought upon.

There is besides a very curious provision of Nature which is little understood, and which comes into play, it would appear, in all animals in the presence of imminent destruction or in cases where great pain presumably exists, either to be inflicted by a natural enemy. We allude to the action of a mouse when in the power of a cat, or of a rabbit when seized by a weasel. In the last instance the rabbit remains motionless, without a sign of pain while being killed; he is apparently, as the expression is, "paralyzed by fear." So also a mouse, and precisely so with man, for Dr. Livingstone's description of his sensations while being shaken by a lion exactly accords with such as we might imagine would be the experience of the mouse, when in the claws of the cat.

But while there is every evidence that the suffering of the lower animals is certainly less than that of man under similar circumstances, we cannot, however, coincide with the idea that it is so far absent, in the case of the brutes ordinarily sacrificed by vivisection, as Dr. Crosby seems to convey. As he states, however, an anæsthetic disposes of the question at once; and in general it is much more humane (and besides is an error on the safer side) to give the unfortunate beasts the benefit of the ether, as well as that of the doubt as to their sensibility.

Straw Lightning Rods.

The *Journal of the Society of Arts*, London, and other papers have given currency to a statement, derived from a prominent French paper, to the effect that lightning rods made of straw had been used in France, and found quite as effective for protection as metal rods, and far cheaper. President Henry Morton, of the Stevens Institute, has written an interesting reply to this statement, given in another column, in which he shows the utter absurdity of the straw lightning rods, and also takes occasion to point out, in a very clear and satisfactory manner, what kind of a rod is necessary to ensure protection, how it should be arranged upon the building, etc. This article will, we are confident, be studied with interest by all who are really desirous of possessing correct information upon the subject.

SCIENTIFIC AND PRACTICAL INFORMATION.

FALL SICKNESS.

In a lengthy article on the above subject, Dr. Hall concludes that if persons in the country where intermittent fevers prevail would adopt the precaution, in early fall, to take their breakfast before going out of doors, and keep a blazing fire upon the hearth in the living room during the morning and evening, fevers and chills would almost entirely disappear as a prevailing disease.

The importance of ridding apartments of the dampness and sharpness of the morning and evening air, and the expulsion of all miasmatic particles, cannot be over-estimated by those who would have good health.

THE FRENCH AND ENGLISH TUNNEL.

The project for the tunnel under the English channel has been officially transmitted from the French Government to the English Foreign Office. Among other plans, it is suggested that the means of inundating the entire bore should be placed in the hands of each government, so that, in case of war breaking out between the two countries, the work may be rendered useless. It is calculated that a force of 2,000 horse power, operating for two months, would be sufficient to pump the water out of the tunnel.

A NEW WHITE ALLOY.

This metal, recently invented by M. Delalot, is said to be very cheap, and to possess qualities rendering it suitable to replace the various white alloys now in use. The proportions are pure red copper 80 parts, oxide of manganese 2 parts, zinc 18 parts, and phosphate of lime 1 part. The copper is first melted and the manganese added little by little. When the latter is dissolved, the phosphate is similarly mingled. The scoria is removed and finally the zinc is added about ten minutes before casting. To accelerate the fusion of the manganese, ½ part fluoride of calcium, ½ part borax, and 1 part wood charcoal may be used as a flux.

THE Boston Board of Fire Commissioners, taught by the recent calamity at Fall River, have issued a circular calling the attention of persons who have on their premises apparatus for preventing the spread of fires, to the necessity of a regular inspection of and instruction and drill in the same. They advise that printed cards, explaining the construction, arrangement, and use of such appliances, be posted where they cannot fail to be seen, and that the occupants be drilled as often as once a week in the use. Where fire escapes are attached to buildings, the board recommend that they be frequently used and examined.

MR. THEODORE J. HARBACH, of Philadelphia, has designed and executed, for the great Centennial event, dies for medals, of a number of historic subjects, such as Old Independence Hall, the Old Cracked Liberty Bell, a Head of Washington, etc. On the obverse sides, persons can have their business cards, making a novel and durable advertisement, which the possessor is likely to keep.

THE AUTOMATIC GAS SAVER.

It has been calculated that the average consumer of illuminating gas, in large cities, is subject to a waste which costs him from one quarter to one third more for gas than is really necessary to produce the requisite light. The reason is obvious from the fact that the pressure, as transmitted from the works, must always be sufficient to insure a full supply, not merely to the highest places, whither the gas rushes at greatest velocity, but to the lowest localities. The normal pressure, therefore, never falls to a point at which no waste at the burner can take place. Nor is it, indeed, possible for the manufacturer to supply each customer with the proper pressure to insure the greatest luminosity, for he is prevented, both by difference of situation of points of delivery and by the constant variation in the quantities drawn from the works by individual consumers. Cutting off at the service cock or using check burners simply reduces the light without affecting the proportional degree of waste; so that the only valid means of avoiding the latter lies in an apparatus which will automatically control the pressure, keeping the same uniformly at the most advantageous point, as the gas leaves the meter.

A new machine for this purpose has lately been patented (May 19, 1874), and engravings of the same are presented herewith. The noticeable feature is the absence of the straight diaphragm, heretofore commonly employed, forming a flat dish, with the valve rod secured to its center, and governing the valve through its being forced upward as the pressure is augmented. The difficulty, due to the hardening of this appliance and consequent loss of its vibratory power, is, it is claimed, obviated in the present apparatus, by making the device of leather, covered with graphite, and in telescopic form, so as to have from one and a half to six inches vibratory motion, according to the size of the machine.

The operation will be understood from the sectional view, Fig. 1.

An increase of pressure, whether it occurs in the mains or service pipe, by putting out lights, is instantly communicated to membrane, A, the tension of which is thereby increased. As the membrane expands it is forced upwards, carrying with it the rod, C, which works the valve, E, and contracts the aperture through which the gas enters chamber, G; the quantity now admitted in a given time being exactly equal to that which passed when the pressure was less and the opening greater. When the pressure again diminishes, the tension of the membrane is of course relaxed, and being forced downwards by the weight in the cup, B, again carries with it the rod, C, and the aperture to the chamber, G, is enlarged. Thus it will be seen that the saver is a self-acting valve, the operation of which depends on the equalization of antagonistic forces, namely, the pressure of the gas within the chamber, G, impelling the membrane outwards, and the weight without impelling it inwards. By the combined action of these very dissimilar agents, the area of this aperture, by which the gas enters chamber, G, is exactly adjusted to the velocity with which it moves. From the chamber, G, the gas escapes by the outlet pipe.

The comparative size of the apparatus and its mode of adjustment to the meter are shown in Fig. 2. The effect upon the flame will also be noticed. The construction is substantial and durable, the best quality of sheet copper, without seam, being used to confine the gas. The valves are ground and fitted so as to control a single burner, and may be readily cleaned of impurities.

The manufacturers add that whoever pays six or eight dollars, or even less, a quarter for gas, will save at the rate of from twenty to forty per cent on his gas bills by using this machine.

Further particulars regarding sales, and also relative to inducements to agents, may be obtained by addressing G. S. Lacey & Co., 615 Broadway, New York city.

Fig. 1.

Fig. 2.

THE AUTOMATIC GAS SAVER.

Action of Sulphuric Acid on Iron and Steel.

Iron or steel wire which has been acted on superficially by sulphuric acid is usually found to be altered in its properties. Its weight is increased, its tenacity is injured, so that, originally soft and flexible, it easily breaks; and when a freshly broken end is moistened by the tongue, it effervesces as if acted on by a mineral acid. These effects after a time disappear. Professor Osborne Reynolds, of Manchester, has ascertained that they are owing to the absorption of hydrogen generated during the chemical reaction which takes place when the wire is immersed in the acid. He found that if an iron tube, closed at one end, be immersed in a dilute solution of sulphuric acid, hydrogen passes through the walls of the tube into the interior, and may be collected by attaching an india rubber tube to the open end of the iron one, and passing it under a gas holder. Professor Reynolds concludes that, whenever iron undergoes oxidation under water, it becomes saturated with hydrogen, and thus loses tenacity—an important consideration in the case of iron steam boilers on iron ships.

CHAIN TOWAGE ON THE ST. LAWRENCE.

By some oversight of our forefathers (not, however, made by the aboriginal Iroquois, whose town of Hochelaga was at the foot of the current), the city of Montreal was built at the head of the rapids; and as, year by year, the trade of the city has increased, the number of vessels and their size has kept pace, until the difficulty of getting ships into the harbor became most formidable, involving great expense in towage, and, in the case of large sailing vessels and light-powered steamers, no inconsiderable delay from the impossibility, with unfavorable winds, of getting tugs enough about a large ship to drag her up the pitch.

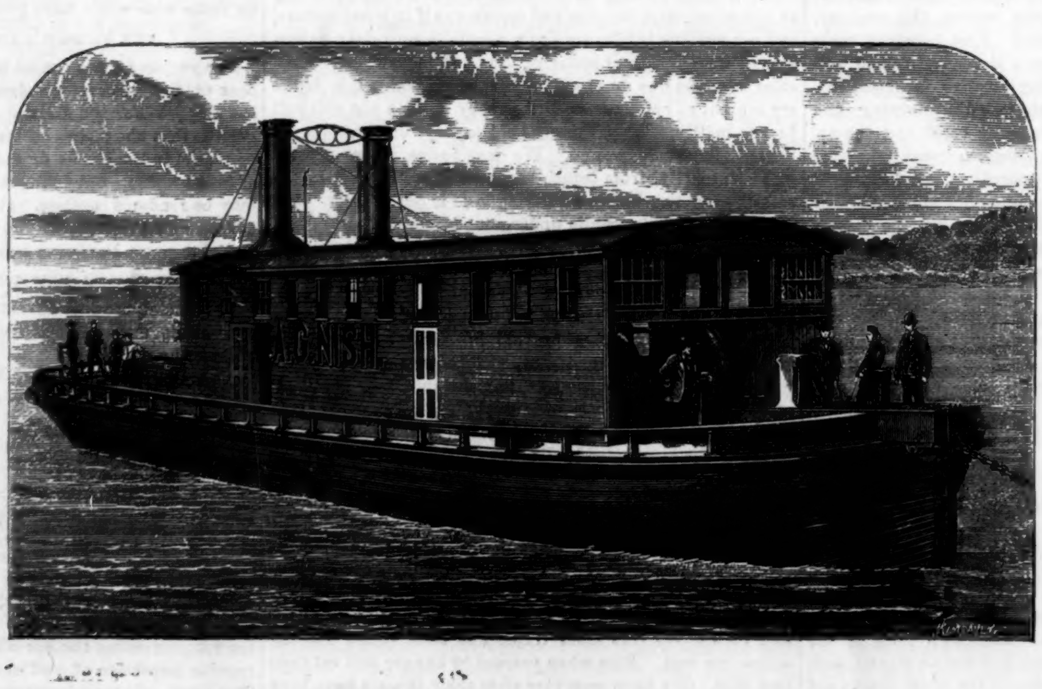
Various schemes were suggested for avoiding the difficulty:—a ship canal coming in behind the city, piers at different points with stationary winding engines, etc.; but eventually Mr. A. Gilbert Nish, the engineer of the Harbor Commissioners, determined, under instructions from the board, to make a trial of the submerged continuous chain system, as used on the Seine below Paris. The circumstances of the two cases were, however, so entirely different that a scheme, which might succeed with the comparatively small barge, and sluggish current of the Seine, would be a total failure with ships and steamers from 1,500 to 3 500 tuns burthen drawing from 20 to 22 feet of water, contending against a volume and velocity of water that, in the event of "taking a shear," will "whip" a 1,500 tun ship to and fro across the current with almost the speed and as little apparent effort as when a current of air plays with a boy's kite.

In designing the new machinery, Mr. Nish, assisted by Captain Wright, the mechanical engineer to the trust, decided that every part should be constructed as strong, and of as few pieces, and as little liable to derangement, as possible. With this end in view, Captain Wright abandoned entirely the wheel gearing used in the wire rope and chain systems of Europe, either as a means of obtaining purchase or connecting the chain drums. The power was obtained by a pair of long stroke engines, and the connection of the chain barrels by coupling rods, set at right angles, similar to those used in locomotives.

With these instructions, Mr. E. E Gilbert, of the Canada Engine Works, Montreal, was intrusted with the work of completing the designs and working out the details. The engines are non-condensing, with cylinders 22 inches by 5 feet stroke. The frames are of the Corliss type, extended to receive the bearing of the outer chain barrel shaft. The weakening effect of lowering the first barrel shaft to the center line of the cylinder is counteracted by using a sufficiently heavy pillow block cap, well fitted in the gibs, to maintain the full section of the frame; the brasses are closed by side keys in the usual manner. The chain barrels are 2 feet in diameter, carrying nine tuns of best $1\frac{1}{4}$ inch short link crane chain, the total length of the chain being 7,000 feet. The two sides are bolted together by heavily flanged crosstie boxes, forming a very rigid structure, which, so far, has proved unyielding under the severest strains. The platform is of cast iron plates, reached by steps from the rear of the cylinders. The whole arrangement has a strong, compact appearance, and works quietly and without vibration under full steam and the severest strains.

The cable was laid early in July, 1873, and the tug brought a large steamer up the rapids on her return trip from laying the chain. She was worked daily until the closing of navigation in November, 1873, without the slightest breakage, delay, or mishap of any kind, and proved in every respect a perfect success, and, in the single instance of hauling the steamer Precursor (which would otherwise have been abandoned) off the rocks, saved her own cost five times over. In hauling off the Precursor, as the usual boiler pressure of 60 or 70 pounds did not appear sufficient to move her, the pressure was gradually increased until, at a little over 90 pounds, the stranded steamer began to slide into the deeper water. As the engines kept barely creeping round, stretching the hawsers as the pressure increased, it is probable that the pressure in the cylinders was nearly that of the boilers.

The speed of the tug against the current is from four and a half to five miles per hour, and the speed of the engines from 55 to 60 revolutions per minute. The expense of fuel, etc., is very small. The principal expense of hands is caused by the number of men required to haul aboard, in a strong current, 100 fathoms of tow line. This, however, it was, when we last heard of the vessel, intended to remedy by the substitution of a donkey engine for manual labor. The total cost of this vessel, of which we here give a perspective view, has been $25,000, including the 7,000 feet of chain.—*Engineering.*



CHAIN TOWAGE ON THE RIVER ST. LAWRENCE.

THE iron establishments of the United States, including furnaces, rolling mills, steel works, forges, and bloomeries, are as follows: 681 completed blast furnaces, 343 rolling mills, 51 steel works, 37 forges, and 47 bloomeries.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER II.

[Continued from page 308.]

In our preceding article we gave a map diagram of the city of New York, showing the general position of the Underground Railway. We also gave a profile of the railway, exhibiting the grades and the various kinds of work along the line; also a view of the first bridge, in front of the Grand Central Depot. We likewise gave a general description of the work from 45th street to 116th street. The last section of open cut begins at this point, and extends to 133d street, where the railway grade rises to the bridge over the Harlem Railway. Referring to the profile given on page 308, it will be seen that this open cut, from 116th to 133d street, which here passes through the most thickly settled portion of Harlem, is arranged at such a depth that it may hereafter be covered over and converted into a beam tunnel should it be deemed necessary, like the beam tunnels now existing on

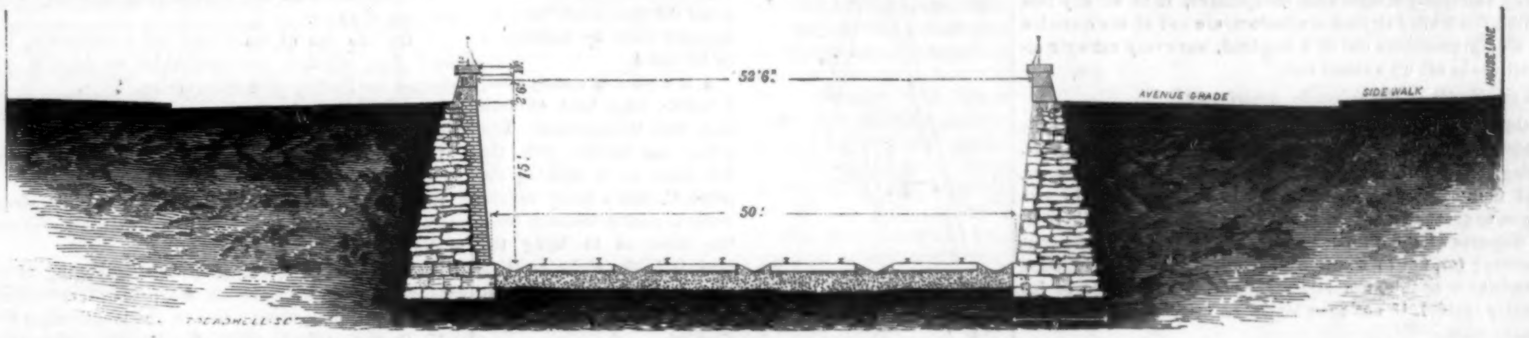


Fig. 4—THE UNDERGROUND RAILWAY IN NEW YORK. CROSS SECTION OF THE OPEN CUT ON FOURTH AVENUE.

other portions of the line. At present there are bridges at cross streets over the open cuts. The total length of the work, from the beginning of the first open cut at 49th street to the ending of the last open cut at 133d street, may be put down in round numbers at 22,462 feet, of which 6,937½ feet consist of open cut, 4,562½ of viaduct, and 10,662 of tunneling, of the three kinds already mentioned.

This tunneling consists of three parallel and separate tunnels, a large one in the center, and on either side a smaller one. In the central tunnel, which has a span of twenty-five feet, are two tracks for the use of the express trains passing north and south; through each of the side tunnels, which have a span of thirteen feet, is a single track for the use of way trains, that on the east for trains passing north, and that on the west for those passing south. These latter tunnels have abundant arched openings for ventilation and light, and are provided at convenient points along the line with passenger stations, to accommodate the local traffic. These stations will be hereafter described.

Such, in brief, is an outline of the general plan of the whole work, and with this sketch we pass to the detailed description of the parts, taking up the work section by section, and limiting our attention to one of these divisions at a time.

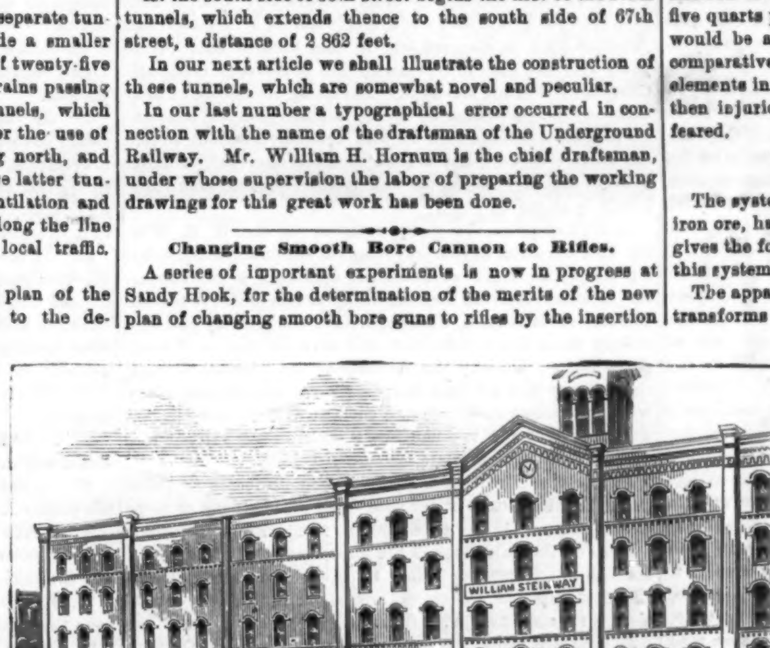


FIG. 5.—THE UNDERGROUND RAILWAY IN NEW YORK. BRIDGE OVER THE OPEN CUT ON FOURTH AVENUE, BETWEEN 52D AND 53D STREETS.

Section 1. From 49th to 79th streets. F. S. Deyo, Division Assistant Engineer. Starting at 49th street, which may be taken as the southern boundary of the work, we enter the first open cut, which, gradually deepening as we proceed northward, extends to the south side of 56th street, a distance of 1,775 feet, at which point it attains its greatest depth of 13 feet. The shape of the cut, therefore, is that of an irregular wedge (the base at 56th and the edge at 49th street), with a breadth at bottom of 50 feet in the clear, from retaining wall to retaining wall, a breadth at top from parapet wall to parapet wall, of 52 6 feet, and a greatest depth of 13 feet. Of this cutting a cross section is given in Fig. 4. It is lined throughout with retaining walls of first class rubble masonry, dressed to a moderate degree of smoothness on the face, well bonded and thoroughly drained with broken stone, the drains occurring about every fifty feet and provided with openings 4 inches by 6 inches. [The open cut, from 116th to 133d streets, is similar to this, except that it is lined with brick masonry. Our engraving, Fig. 4, represents stone linings one side and brick on the other.] In general the walls extend three feet below the grade of the road, and are nine feet thick up to grade, where the thickness changes to seven feet, and then tapers off toward the top with a batter of one inch to the foot. Although the thickness of the retaining wall, both at top and bottom, will, of course, vary with the hight, the thickness at the top is in no case greater than four feet, or less than two feet six inches; or, at the bottom, greater than thirteen feet, or less than four feet, the greatest thickness at top and bottom occurring in the retaining walls of the viaduct at 104th street, where the dimensions are 29x13x4. The general proportions of the walls, in the open cut below 56th street, may be given as 15x7x2·6. The stones in the face of the wall are laid with vertical and horizontal joints in cement mortar, and plastered on the back with half an inch of cement mortar well rubbed down. This mortar is composed of the best quality of Ulster county hydraulic cement and clean fine sand, in the proportion of one part of the former to two parts of the latter, the ingredients being thoroughly mixed when dry. After water has been added, the mortar is not allowed to stand for any length of time.

Along the top of the retaining wall runs a parapet wall of first class cut granite, with joints and beds dressed to lay three eighths of an inch. The dimensions of this wall are, in general, a breadth of two feet at bottom, eighteen inches on top, and a hight of two feet six inches. On the parapet is placed the coping of granite, ten inches thick by twenty two wide, pene hammer dressed on the outside faces, and beveled on the sides, and prepared to lay quarter inch joints. All this is surmounted by a light wrought iron railing. Over this cut the street crossings, with the exception of those of 52d and 53d streets, are iron plate girder bridges, to be here after described. To accommodate the cross street traffic at 52d and 53d streets, one bridge is constructed midway in the block bounded by these streets, the approaches being placed at right angles to the length of the bridge, an expedient rendered necessary by the impossibility of constructing them in the usual way, on account of the hight and length of the bridge and the narrowness of the avenue, the span of the former being fifty-two feet six inches, and the width of the avenue one hundred and four feet. Our engraving, Fig. 5, is a perspective sketch of this bridge.

At the south side of 56th street begins the first of the beam tunnels, which extends thence to the south side of 67th street, a distance of 2 862 feet.

In our next article we shall illustrate the construction of these tunnels, which are somewhat novel and peculiar.

In our last number a typographical error occurred in connection with the name of the draftsman of the Underground Railway. Mr. William H. Hornum is the chief draftsman, under whose supervision the labor of preparing the working drawings for this great work has been done.

Changing Smooth Bore Cannon to Rifles.

A series of important experiments is now in progress at Sandy Hook, for the determination of the merits of the new plan of changing smooth bore guns to rifles by the insertion of a coiled wrought iron cylinder, secured in position by a collar at the muzzle of the gun. A 10 inch smooth bore is thus converted into an 8 inch rifle. If the system proves successful, it will enable the Government to utilize a large number of guns now useless. The casemates of almost all the fortifications of the United States have been built of a size admitting no larger piece than the 10 inch cannon, and it has been suggested that, by a steel cylinder instead of one of wrought iron, a gun of the above caliber may be altered even to a 9 inch rifle.

Experiments thus far made demonstrate that, while the 10 inch smooth bore uses a projectile weighing 127 pounds, the same gun, altered, gives nearly double the force, a more even rate of speed, greater penetration, and increased accuracy, with a shot of 186 pounds.

Precipitation of Zinc by Water.

Zinc may be added to the list of metals which can be precipitated by means of water. The conditions seem to be these: If, to a solution of zinc chloride, just sufficient only of ammonia be added to re-dissolve the precipitate at first formed, the addition of water throws down zinc in the form of a gelatinous and bulky precipitate. In the cold, the whole of the zinc is not thus precipitated, but possibly with continued boiling it might be.—*J. L. Davies—Chemical News.*

Influence of Gas Refuse on Fish.

Professor Wagner, of Munich, has recently investigated the above named subject, and the conclusions he reaches are as follows: Fish put in water to which one per cent of gas refuse had been added became at once very restless, tried to jump out, turned on their backs after they had been in the polluted water for one minute, and were dead after the lapse of six minutes. In water containing one half per cent or one quarter per cent of gas refuse, the fish were killed in half an hour and an hour and a half respectively. The addition of one tenth per cent of the substance killed the fish in about seven hours.

Professor Wagner recommends that, instead of throwing the refuse into streams in quantities at a time, it should be allowed to flow in very gradually, at a rate not exceeding five quarts per minute. By this means, these small amounts would be at once diluted to such an extent as to become comparatively harmless, chemical decomposition of their elements in the river water setting in at the same time; and then injurious influence on pisciculture need no longer be feared.

Steel Direct from the Ore.

The system of Ponsard, for producing steel direct from iron ore, has attracted much attention, and *La Metallurgie* gives the following account of a recent experiment made on this system.

The apparatus consists principally of a gazogene, which transforms the fuel in a series of large chambers, and of an apparatus in brick, called the recuperator of heat, which receives the flames from the furnace, and restores the caloric in the form of hot air. The compartments of the chamber serve successively for the reduction of the ore, for the reactions which are effected, and, finally, for the fusion of the whole charge in such a manner that the separation of the component parts is effected by the difference of density. These various phases of the operation require very different temperatures, and the production of these is the special object of the apparatus. On the side of the furnace doors the temperature is only that of red heat, while beyond the heat is so great that the eye is unable to support the intensity of the glow. This extraordinary heat is estimated at 3,632° Fah.

The success of the experiment is reported to have surpassed all expectation, and the result obtained is considered to demonstrate the possibility of producing steel direct from the ore without any of the transformations necessary under existing systems. Of course this is a fresh revolution in the history of metallurgical industry; and it is almost unnecessary to add that, should the system justify the report, it will prove a revolution indeed.

The Most Eminent American.

The most eminent living American is William Cullen Bryant, of New York city, poet, author, editor, and publisher. Born in 1794, in Massachusetts, he is now in the 81st year of his age, still active and vigorous both in body and mind. His first volume of poems was published in 1808, in his fourteenth year, and from that time to the present, a period of 66 years, he has been a constant contributor to the literature of the world. For the past 48 years he has been editor and proprietor of the New York *Evening Post* newspaper. On the recent occasion of his 80th birthday, November 4, 1874, he was waited upon by a number of our most prominent citizens, and heartily congratulated for his continued health and long and useful life. He spoke, in reply, of the remarkable changes that had taken place in the political affairs of the world during his lifetime. What marvelous discoveries have been made, too, in the world of Science during the same period!

Correspondence.

Straw Lightning Conductors.

"Straw is about the last material one would think of using for a "lightning rod;" but according to a French journal, it answers the purpose admirably. It had been observed that the straw had the property of discharging Leyden jars without spark or explosion, and some one in the neighborhood of Tarbes got the idea of constructing lightning conductors, which were formed by fastening a wisp or rope of straw to a deal stick by means of brass wire, and capping the conductor with a copper point. It is asserted that the experiment has been tried on a large scale around Tarbes, eighteen communes having been provided with such straw conductors, only one being erected for every 60 arpents, or 750 acres, and that the whole neighborhood has thus been preserved from the effects, not only of lightning, but of hail also. *The Journal of the Society of Arts* says: This statement comes from a respectable source; and the apparatus being extremely simple and inexpensive, it is at any rate worth the trial. Copper conductors are out of the question in ninety-nine cases out of a hundred, but every cottager almost could set up a straw one."

To the Editor of the Scientific American:

On reading the above account of straw lightning rods which you sent me, I made the simple experiment of measuring the electrical resistance of a small bundle of straws, and found it to be very high indeed, say a million or two times as great as a copper wire of the same size. This really disposes of the question of usefulness for lightning conductors; for, not to mention other considerations, with such a resistance as this, the straw rod, if struck, would be instantly ignited, if not even blown to pieces by an explosive combustion.

The real question of most importance to a lightning rod is, however, not what will become of it after it is struck, but, strange as it may sound when first stated, what certainty there is of its being struck. Thus: Suppose it to be proved that a given rod if struck would carry to the ground all the electricity entering it, but that this same rod was far less likely to be struck than the adjacent gable of the house: What use would such a thing be as a protection? Evidently we have first to consider the conditions which will secure the striking of the rod in preference to anything else near it, and then it will be time to inquire as to its capacity to carry off the fluid when it gets it.

I have already indicated, on a previous occasion, and you have ably discussed, the very simple conditions involved in this first and most important problem. Briefly they are these: That the lightning rod should offer a path to the earth presenting many hundred times less resistance than any of the neighboring accidental paths, made up of metal pipes, rods, nails, bolts, hinges, stove pipes, gutters, and the like, interspersed with woodwork, human beings, and other destructible matter. The electric fluid, when it finds presented to it two equally good roads, impartially divides itself and sends half its substance by each route. If it finds two routes where the obstructions or resistances are as one to ten, then it sends ten times as much of itself by the easy as by the difficult road. In order that a rod, therefore, should keep all of a flash to itself, it must offer immensely superior inducements in the way of conduction to the ground. If it does this, then it is an absolute protection to all around it, and not otherwise. Now experiment has proved beyond a question that the conducting power of a given substance varies with its cross section or weight per running foot; and therefore, when we take a rod of some good conductor, such as copper, and make it thick and connect it thoroughly with the earth, we get an easy path to the earth, for any cloud-collected electric fluid. What we must do, moreover, is to make this path so easy that no chance road shall come anywhere near it for easiness.

Under the existing state of affairs, with the large quantity of metal used in our buildings, this can only be done when we have either a very thick rod or its equivalent obtained by uniting the rod near the roof to the very water, gas, and other pipes which would otherwise be its rivals. A conductor fulfilling the above conditions will always be easily able to carry all the electricity that strikes it. We constantly see recommendations of this or that form of rod because it has more surface, and electricity of high tension travels chiefly on the surface. Grant that this last statement applies in full force to lightning, yet we see that it is of no practical importance. Increase of surface will not diminish resistance or improve conducting power. This we know by countless experiments, and the opposite is not even claimed. If, therefore, a certain rod has not substance enough in it to make it an efficiently good conductor, squeezing or twisting it into any possible form will not do it any good in the direction of securing the attention of the lightning to it; and if it is not struck, of what comfort is it to believe that, if the lightning (which went into the house and set fire to it or killed the inmates) had only gone to the rod, it would have traveled to its own delight on the outside of the same? Lightning is not to be outmanœuvered cheaply in this way, either by a thin piece of metal, whose insufficient conducting power is *not* increased by giving it a ribbed surface or a spiral twist, nor by a non-conducting straw.

I have said nothing here of another way in which the low resistance of a lightning rod is effective, namely, in facilitating induction and thus charging itself and the air above it oppositely to the thundercloud, by which means the discharge is still further determined in the line of the rod. But this only adds to the force of my former argument in favor of good and abundant conductors.

In conclusion, I can only regard the French straw theory as a *canard*, though if it had originated in this State (New Jersey) I should have considered it only the consequence of a verbal ambiguity, as we know that New Jersey lightning, moderately diluted, passes with great facility along a straw.

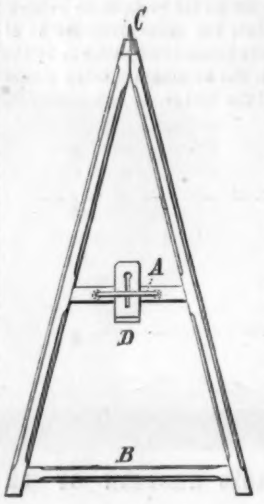
Stevens Institute of Technology. HENRY MORTON.

[Possibly some of our readers may not be familiar with the fact that apple whisky is known by the name of New Jersey lightning.—EDS.]

Grinding Plane Irons.

To the Editor of the Scientific American:

Seeing in a recent number of your paper a description of a device for equalizing the wear on grindstones, I send you an illustration of a holder for plane irons, chisels, etc, with which one man can both turn the stone and grind the tool much more accurately than by holding it in his hand.



A is a piece of spring steel, 8 inches long, bent at each end, with thumbscrew. You grasp the holder with the left hand, at B, sticking the point, C, into a board or the wall, at such a distance from the stone as to bring the iron, D, in the right position on the stone. By raising or lowering C, the bevel is regulated.

J. M. RICHARDSON.
East Cleveland, Ohio.

Cable Telegraphy.

To the Editor of the Scientific American:

In your issue of November 7, 1874, you publish a communication from Mr. T. A. Edison, Newark, N. J., referring to a paper read before the British Association by W. K. Winter, on an improvement in cable telegraphy. Mr. Edison says that the principle shown was invented by himself, and patented both in England and in this country some three years ago, and that it is used by the Automatic Telegraph Company. Permit me, as the consulting electrician of that company (and as owner of all the electro-chemical automatic telegraph patents used by said company), to deny *in toto* the above assertion, and to show how the case really stands, in order that Mr. Edison (as well as other parties) may know how it is himself.

In the first place, the party referred to, Mr. W. K. Winter does not claim any improvement in automatic telegraphy, but simply an improved method of operating a galvanometer or other receiving instrument by means of the induction coil and earth contact, wherein he uses the primary and secondary wires of an induction coil as a balance or Wheatstone bridge, whereby the increase of the current through the primary wire not only induces a current in the secondary wire, but causes a self-induced current to flow, being in fact an equivalent for the condenser with shunt helix. Mr. Winter's patent bears date December 6, 1872.

In the second place, Mr. T. A. Edison professes to claim (in an English patent under date April 26, 1873) one or more electro-magnets in the shunt circuit, to neutralize the attenuations of the pulsations in the main line circuit, and bring the line to a normal condition, to prevent tailing upon the chemical paper of a chemical telegraph: in fact, an equivalent for a condenser with shunt helix.

In the third place, I claim (under patents of dates October 18, 1870, August 29, 1871, April 9, 1872, April 22, 1872, September 10, 1872, September 2, 1873) the use of electro-magnetic rheostats, rheostat overflow dams, condensers with shunt helices, or accumulators *per se*, in a shunt or branch circuit, in combination with an electro-chemical automatic telegraph, to bring the line to a normal condition, prevent tailing, and produce rapid work.

As a twenty years' subscriber to your valuable journal, I ask that you will do me the justice of inserting this my reply.

Passaic City, N. J. GEORGE LITTLE, C. E.

A SIMPLE PLAN OF VENTILATION.—The following simple method for ventilating ordinary sleeping and dwelling rooms is recommended by Mr. Hinton in his "Physiology for Practical Use": A piece of wood, three inches high and exactly as long as the breadth of the window, is to be prepared. Let the sash be now raised, the slip of wood placed on the sill, and the sash drawn closely upon it. If the slip has been well fitted, there will be no draft in consequence of this displacement of the sash at its lower part; but the top of the lower sash will overlap the bottom of the upper one, and between the two bars perpendicular currents of air, not felt as draft, will enter and leave the room.

IN causing anæsthesia by subcutaneous injections of chloral, M. Colin states that weak solutions should be used; and when forced into veins, the operation should be performed very slowly, so as not to cause syncope. Veins near to articulations should be avoided.

M. HANNECKER uses for the oxyhydrogen light (and obtains increased brilliance) a cylinder composed of carbonate of lime, magnesia, and olivine, compressed by hydraulic pressure. The olivine used is a natural silicate of magnesia

Institution of Naval Architects.

The Institution of Naval Architects, John street, Adelphi, London, have issued the following list of subjects on which communications are desired:

1. On the construction and armament of ships of war.
2. The effect on naval construction of torpedoes or other modes of submarine attack.
3. On the life and cost of maintenance of merchant steamships.
4. On the preservation of the hulls and cargoes of ships from the effect of bilge water, leakage, condensation, and other causes of internal decay and corrosion.
5. On the disposition and construction of bulkheads, and on their attachment to the sides of iron ships.
6. On the masting of ships, and on iron and steel masts and yards.
7. On the ventilation of ships by natural and forced drafts, with details of any system in actual operation.
8. On the fouling of ships' bottoms and its prevention.
9. On machines for the economizing of labor in the construction of ships.
10. On the use of machinery for economizing labor on board ship, whether merchant ships or ships of war, and whether for loading or manœuvering.
11. On telegraphic or other communication of orders on board ship.
12. On the construction of slips and launching ways, and on the launching of large ships.
13. On the present state of knowledge of the strength of materials as applied to shipbuilding, with especial reference to the use of steel.
14. On methods for the proper strengthening of ships of extreme proportions, and on the precautions necessary to insure their safety at sea; also on the lengthening of ships.
15. On the straining effect of engines of high power on the structure of ships, and the arrangements necessary to obviate them.
16. On legislative interference with the construction, stowage, and equipment of ships.
17. The design, construction, and measurement of yachts.
18. On floating structures other than ships, such as docks, lighters, pontoons, and so forth.
19. On ships for special purposes, such as light ships, telegraph ships, cattle and special passenger ships, and others.
20. Actual measurements or records of sea waves; their hight, length, periodic time, and speed of advance; or their profiles.
21. On the results of the best modern practice in ocean steam navigation, with reference to the latest modern improvements, such as surface condensation, superheating, compound engines, and the like; also the value of each of these taken separately, and especially the results of any actual experiments to test this point.
22. On the friction developed in marine steam engines of different forms; and on the difference between the gross indicated horse power developed in the cylinder, and the net effective horse power available for the propulsion of the ship after working the air pump, slide valves, and other moving parts of the engine.
23. On economy of fuel in marine engines, with detailed results.
24. On methods for starting, stopping, and reversing marine steam engines of high power.
25. On marine boilers, their form, rate of combustion, and the proportion of their various parts.
26. Information as to the alleged rapid deterioration of marine boilers supplied with water from surface condensers, and the remedies for the same.
27. Exact information—either experimental or theoretical—on the efficiency of propellers.
28. On any novelties in the construction, equipment, or fitting of ships.
29. On any novelties in the construction, arrangement, or details of marine engines and propellers.

Iron Ore Bed in New York City.

We find it stated in several of our English contemporaries (and it will be news to most of our residents) that "some excitement has been aroused in New York by the discovery of a rich vein of hematite iron ore in the heart of the city, by some workmen who were digging foundations for a new building. The vein, which is 30 feet wide, was found at a depth of only 4 feet from the surface." We expect to hear, by the next foreign mail, of the erection of a smelting furnace at the mine "in the heart of the city."

We were led, by this startling announcement from across the water, to inquire into the facts of the remarkable discovery; and we learn that some laborers, engaged in digging a foundation on the corner of Washington and North Moore streets, struck a layer of scoria and cinders, the *débris* of some furnace, which had been used for filling in the ground a long time ago. Our reporter was shown some specimens of the "ore," deposited in barrels by the workmen, who seemed quite delighted at the sensation which their discovery had created abroad.

Curious Apples.

Doubts are entertained by some pomologists as regards the truth of the statement made that apples have been grown in which two or more varieties were blended into one, that is, apples having one section sweet and the other sour. We have seen such fruit and therefore know that it has been produced. A tree bearing apples of this nature formerly stood in a gentleman's garden in Georgetown, Mass. It was of large size, and in some years produced several bushels of

ruit. The owner sold the apples as curiosities, and frequently individual specimens brought large prices. It was exceedingly interesting to examine the crop, as one apple differed widely from another, and there was difficulty in finding two precisely alike. A few were found in which almost exactly one half was sweet and the opposite sour, but a majority were made up differently. Sections, one quarter or one sixteenth, more or less, would be sweet or sour, and the remainder would be of the opposite kind. The line of demarcation on the skin was distinctly defined, the sour portion having a reddish color, while the sweet was of a pale green. There was no mistaking the flavor; the sour portion was very sour, and the sweet very sweet. On the same tree apples grew which were uniform in kind, some being entirely sweet and others entirely sour.

This pomological freak was brought about by a careful process of budding, two buds of different varieties being divided, and one half of each joined together, so as to adhere and grow in that condition. As none of this fruit has been seen of late years, we conclude that the tree has perished.—*Boston Journal of Chemistry.*

We can corroborate the foregoing, having ourselves seen them growing, and tasted apples that were sweet on one half and sour on the other. This was several years ago. The tree which produced this curious fruit was upon the premises of the Rev. Dr. Ely, of Monson, Hampden county, Mass.

PRACTICAL MECHANISM.

NUMBER XIII.

BY JOSHUA ROSE.

PISTON RINGS.

The tension referred to in our last (see page 293) is, in all probability, caused by the unequal cooling of the ring after it is cast.

Iron and brass molders generally extract castings from the mold as soon as they are cool enough to permit of being removed, and then sprinkle the sand with water, to cool and save it as much as possible. The consequence is that the part of the casting exposed to the air cools more rapidly than the part covered or partly covered by the sand, which creates a tension of the skin or outside of the casting. The same effect is produced, and to a greater extent, if water is sprinkled on one part of a casting and not on the other, or even on one part more than on another.

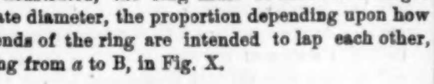
It has already been stated that brasses contract a little, sideways, in the process of boring, and that work of cast metal alters its form from the skin of the metal being removed; this alteration of form, in both cases, arises in the case of a piston ring from the release of the tension.

It sometimes occurs that a piece of work that is finished true in all its parts may unexpectedly require a cut to be taken off an unfinished part (to allow clearance or for other cause), and that the removal of the rough skin throws the work out of true in its various parts, as, for instance: a saddle of a lathe being scraped to fit the lathe bed, and its slides finely scraped to a surface plate; or the rest itself being fitted and adjusted to the cross slide of the saddle. If, when the nut and screw of the cross slide are placed in position, the nut is discovered to bind against the groove (of the saddle) along which it moves (the nut being too thin to permit of any more being taken off it), there is no alternative but to plane the groove in the saddle deeper, which operation will cause the saddle to warp, destroying its fit upon the lathe bed, and the trueness of the Vs of the cross slide, and that to such an extent as to sometimes require them to be refitted.

The evil effects of this tension may be reduced to a minimum by taking the castings from the sand and placing them in a heap in some convenient part of the foundery, and covering them with sand kept in that place for the purpose: and by roughing out all the parts of the work which are to be cut at one chucking before finishing any one part.

Piston rings are turned larger than the bore of the cylinder which they are intended to fit, and, as before stated, sprung into the cylinder. The amount to which they are turned larger depends upon the form of split intended to be given to the ring; if it be a straight one, cut at an angle to the face of the ring, which is the form commonly employed, the diameter of the ring may be made in the proportion of one quarter inch per foot larger than the bore of the cylinder, sufficient being cut out of the ring, on one side of the split, to permit the ring to spring in to the diameter of the cylinder, when the ring may be placed in the cylinder and filed to fit, taking care to keep the ring true in the cylinder while revolving it to mark it. But if the ring is intended to be of the form here illustrated, the ring must be made of a larger proportionate diameter, the proportion depending upon how much the ends of the ring are intended to lap each other, the lap being from *a* to B, in Fig. X.

Fig. X.



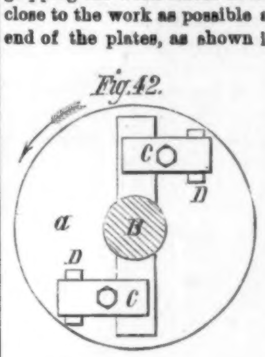
There is more work entailed in giving a piston ring this form of split, but it is undoubtedly superior to the plain one. Another plan to give spring to a piston ring is to turn it to the same diameter as the bore of the cylinder, and then to pene it all round on the inside face (that is, the bore), the result being that, when the ring is sawn in two (which is all that is necessary in this case), it will spring open and be of a larger diameter. When, however, it is placed in the cylinder, it will require to be sprung together again to the diameter to which it was turned (the split being open to the width of the split cut by the saw), so that it will not require much, if any, filing to fit it to the cylinder.

LATHE WORK.

When bolts and plates are employed to hold rough work, care must be taken to place the plates over those parts of the work which touch against the chuck or face plate against which the work is bolted; or the pressure of the plates on the work will spring it, and when it is taken out of the lathe (or other machine) it will spring back to its original position, and the part that has been cut will be no longer true, causing in many cases a great deal of unnecessary vise work. If it is not practicable to so place the plates, then those parts of the work which stand off from the face plate or chuck should be kept from springing by having wedges driven between them and the plate, which is of great importance in light work.

The plates (or clamps) should be so placed that the ends gripping the work travel in advance, the bolts being kept as close to the work as possible and the packing at the other end of the plates, as shown in Fig. 42. *a a* represents the chuck plate, B is the work, C C are the plates, and D D are the packing pieces. Heavy cast iron work requiring much turning to be done to it between the centers should have wrought iron plugs screwed on the ends, and the centers put into the wrought iron; because centers, if of cast iron, cut, and soon run out of truth. Before boring or turning work that is chucked, if there is sufficient room, put a rod of iron between the centers to counteract any end play there may be in the spindle of the lathe. In applying a steady rest, be careful not to put an unequal strain on the work by screwing any of the jaws tighter than the others, or it will spring the work out of the straight line, in which case the cut taken by the tool will not be parallel. When there is sufficient room, use a boring bar with a small tool in it for boring holes; for the extra strength of the boring bar enables the tool to take a heavy cut, which a boring tool having a slight body would not do, in consequence of the springing.

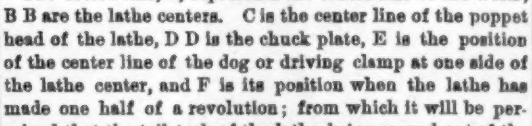
Fig. 42.



If work chucked in a lathe is much heavier on one side than on the other, bolt a weight on the chuck (near the light side of the work) sufficiently heavy to counterbalance it, otherwise the centrifugal force generated by the revolutions of the heavy side of the work will cause it to revolve eccentrically, and to be in consequence turned untrue.

In turning a cone on anything which is held between the centers of the lathe, the dog or clamp used to drive the work must be so placed as to be able to move to accommodate the varying angle of the center line of the work to the center line of the poppet head of the lathe, as illustrated in Fig. 43.

Fig. 43.



The dotted line, *a*, represents the center line of the work; B B are the lathe centers. C is the center line of the poppet head of the lathe, D D is the chuck plate, E is the position of the center line of the dog or driving clamp at one side of the lathe center, and F is its position when the lathe has made one half of a revolution; from which it will be perceived that the tailstock of the lathe, being moved out of the center line of the headstock of the lathe, the end of the dog or clamp which is driving the work advances toward and recedes from the chuck plate at every revolution, and liberty must therefore be given it to move in that manner.

In boring brasses for journals, place a piece of sheet tin in the joint of the brasses, and bore them the thickness of the tin too large, which will make them fit well on the crown when the tin is taken out; for brasses bored with the joints close together always bind on the sides, and will not fit down on the crown without being filed.

The same end may be attained by boring the brasses a trifle too large, so that filing a little off the faces of the joint will let them together and down on the crown; but the above described plan is the best.

The amount of shrinkage to be allowed for contraction, on holes in cast iron of two or less inches bore, should be so little that, the outside callipers being gaged to touch the shaft very lightly and the inside callipers or gage to touch the hole only sufficiently to feel the touch, you can just see plainly between the two when they are placed or gaged together.

For larger sized bores, proportionately increased allowance should be made, so that a hole of 12 inches diameter will have less than $\frac{1}{64}$ of an inch of shrinkage. Wrought iron may be given a little more shrinkage, and steel one half less in the case of the 12 inch hole.

EXPANSION AND CONTRACTION.

Much labor and expense may often be saved by employing the principles of expansion and contraction to refit work. For instance, suppose a bolt has worn loose: the bolt may be hardened by the common prussiate of potash process, which will cause it to increase in size, both in length and diameter. The hole may be also hardened in the same way which will decrease its diameter; and if the decrease is more than necessary, the hole may be ground or "lapped" out by means of a lap. A lap is a mandril used to grind holes which are not quite true, are a trifle too small, or have been hardened and cannot therefore be cut by a tool. A lap may be simply a piece of rod copper, or an iron mandril with tin or lead cast around it. The diameter of a lap should be turned to be an easy fit at both ends in the hole and a trifle larger in the middle, so that the hole which it is intended to grind will fit tightly on the middle of the mandril, the latter being about three times the length of the former.

The operation is to place the lap through the hole which it is to grind and then between the centers of the lathe; then, while the lathe is running at a high speed, supply the lap with oil and grain emery, moving the work back and forth along the lap until it will pass easily from end to end, when the lathe may be stopped and the lap indented with a cold chisel, and supplied with oil and emery, and the grinding operation proceeded with as before. The work should be held upright and on each side of the lathe alternately, so that its weight shall not cause the grinding to be excessive on one side of the hole. Only about $\frac{1}{64}$ of an inch of shrinkage can be obtained on a hole and bolt by hardening, which, however, is highly advantageous when it is sufficient, because both the hole and the bolt will wear longer for being hardened.

For closing long holes, boxes, etc., the water process may be employed, as represented in Fig. 44. *a a* is the section of a wrought iron square box or tube, which is supposed to be made red hot and placed suddenly in the water, B, from its end, C, to the point, D; the result is that the metal in the water, from C to D, contracts or shrinks in diameter, and compresses the hot metal immediately above the water line, as the small cone at D denotes. If then the box or tube is slowly immersed in the water, its form, when cold, will be as described in Fig. 45, that part from C to D maintaining its original size, and the remainder being smaller.

Fig. 44.

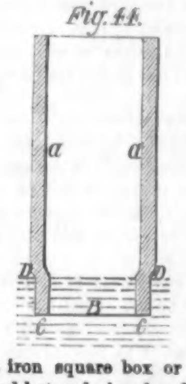
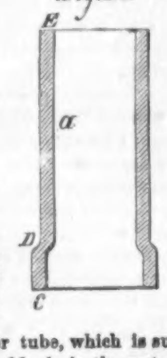


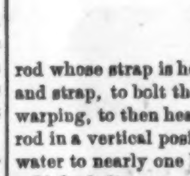
Fig. 45.



It must then be reheated and suddenly immersed from the end, E, nearly to D, until it is cold, and then slowly lowered in the water, as before, which will contract the part from D to C, making the entire length parallel but smaller, both in diameter and bore, than before it was thus operated upon.

Small holes to be reduced in bore by this process should be filled with fire clay, and the faces nearly or wholly covered with the same substance, so that the water will first cool the circumference, as shown in Fig. 46. *a* represents the hole, B the circumference of the washer supposed to be operated on, and the dotted line, C, the fire clay filling the hole and nearly covering the face; so that the part not covered will cool first, and, in contracting, force inwards the metal round the hole, which is prevented from cooling so quickly by the clay and therefore gives way to the compressing force of the outside and cooler metal.

Fig. 46.



This principle may be made use of for numerous purposes, as for reducing diameters of the tyres of wheels, reducing the size of wrought iron bands, or for closing-in connecting rod straps to refit them to the block end, the mode of operation for which is, in the case of a rod whose strap is held by bolts running through the block and strap, to bolt the strap on the rod to prevent it from warping, to then heat the back of the strap, and (holding the rod in a vertical position) submerge the back of the strap in water to nearly one half its thickness.

If the bolts are not worn in the holes, or if the strap is one having a gib and key, they may be merely put into their places without placing the strap on the rod. Even a plain piece of iron shrinks by being heated and plunged into water, but only to a slight degree, and the operation cannot be successfully repeated. Eccentric rods which require to be shortened, say $\frac{1}{64}$ of an inch, may be operated on in this manner, in which case care must be taken to immerse them evenly so as not to warp them.

Prizes for Essays.

The Academy of Arts, Science and Belles Lettres of Caen, France, offers a prize of eight hundred dollars for an essay on the subject of the functions of leaves in the vegetation of plants. A dissertation on the present state of science on this question, including the results of personal experiment, showing new facts tending to confirm or modify the doubtful points in theories now admitted, is required. The papers must be submitted before January 1, 1876.

Another prize, of one hundred dollars, is offered by the Academy of Sciences of Rouen, for a treatise on the advantages to be obtained by the conservation and improvement of cider by the employment of the processes of heating now applied to wines. The award will be made during the coming year.

Tests for Oils.

The testing of oils, in a simple mode, has always been a desideratum. Miss Kate Crane, in the *American Journal of Pharmacy*, gives an account of a series of experiments instituted by her, which tend to show that much reliance can be placed on the cohesion figures produced by dropping oils on the surface of clean water. In her experiments, a single drop of oil was allowed to fall from a burette held at a distance of four inches from the surface of a dish of clean water. The time required for the production of certain figures was carefully noted, as it appears that several oils will produce very similar figures ultimately, if sufficient time be given. Oil of turpentine spreads out instantly and begins intestine motions, and lastly forms a beautiful lacework. Oil of cinnamon forms a figure not more than half the size of the above. In a few seconds, small portions are detached and separate into distinct drops. Oil of nutmeg forms a large figure instantly, the edge showing a beaded line. Poppy seed oil spreads instantly to a large figure, retaining an unbroken form for a few seconds; then holes appear round the edge, and soon the whole surface is broken up with curved lines. Cod liver oil spreads into a large film; a little way from the edge small holes appear, and in a minute or two the surface is studded with them. These gradually enlarge, assume irregular shapes, and become separated by branching lines. As these oils give different figures, and behave differently when mixed with one another or with lard oil, this method may be of very great use in the preliminary testing of suspected oils.

A NEW DETACHABLE HORSESHOE.

The improved horseshoe represented in the annexed illustration is so constructed that it may be put on or removed from the hoof without requiring the labor of the blacksmith. When constructed of malleable iron, its cost need not be over half that of the ordinary shoe, while it is much more durable, there being no wearing out of the rim, if that portion be constructed, as it easily may be, of steel. The inventor suggests that the device is especially adapted for use in the army, and that it might be made in various sizes, and thus issued, nothing further than a rasp, in the hands of a cavalry soldier or artilleryman, being needed to fit the shoe to the horse's hoof.

The invention, as shown in section, in Fig. 3 of our engraving, is made in two parts, A and B, fastened together by dovetails, C, at the heel, and a screw, D, at the toe. The lower part has toe and heel calks, and the foot of the horse rests upon its upper side. The portion, B, forms a metallic rim around the hoof, covering the edge of the same, so that

Fig. 1

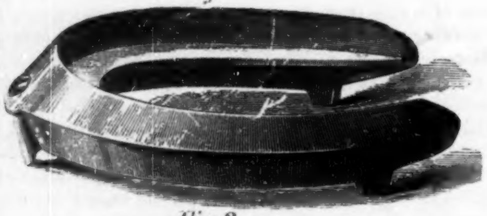


Fig. 2

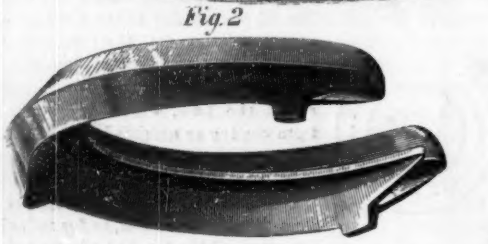


Fig. 3

when the parts are screwed together by screw, D, the shoe is firmly held. By placing a cloth or rubber cushion beneath the foot, the fit of the shoe may be tightened, and of course, by loosening the screw, the shoe may be easily removed.

Exterior views of the device, from above and from underneath, are given in Figs. 1 and 2. By its use, the horse's feet are left in their natural state, only requiring to be rasped off occasionally as the hoof grows. The shoes may be removed when the animal is turned out to pasture or when in the stall.

The inventor states that the entire shoe, ready for use, can be made for from twenty to thirty cents, and that, even if it be provided with a fancy polished rim of brass or other metal, its cost will not be so great as that of the common shoe.

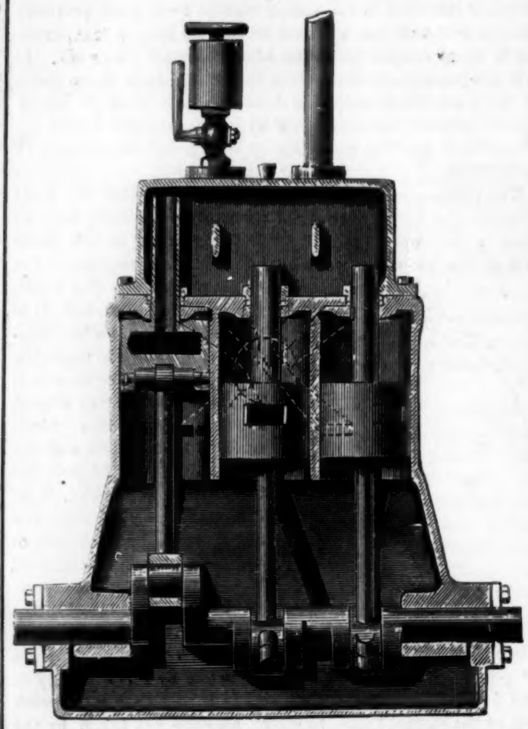
Patented through the Scientific American Patent Agency, August 25, 1874. For further particulars address the inventor, Mr. Luther W. Griswold, Marshalltown, Marshall county, Iowa.

A VALUABLE GIFT.—The Cincinnati *Gazette* states that Thomas H. Yeatman, Esq., has presented to the Young Men's Christian Association Free Library, of that city, a complete set of the volumes of the SCIENTIFIC AMERICAN. They comprise thirty bound volumes, and extend from 1859 to 1874 This is a rare and valuable gift.

WILLANS' THREE-CYLINDER ENGINE.

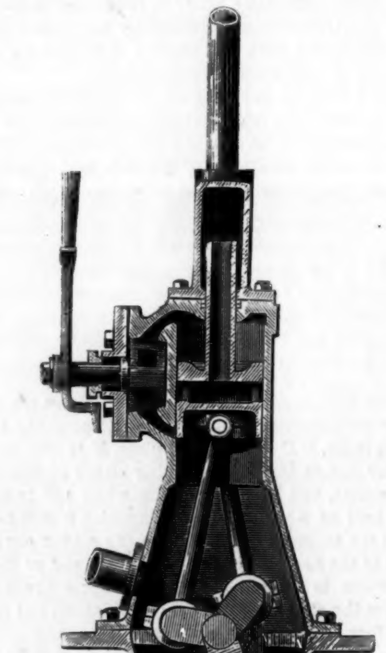
We illustrate herewith an ingenious and very neat arrangement of three cylinder engine, designed by Mr. P. W. Willans, of Greenwich, England, which is now in use for driving a fan, etc., at the works of Messrs. John Penn & Co., of

Fig. 1.



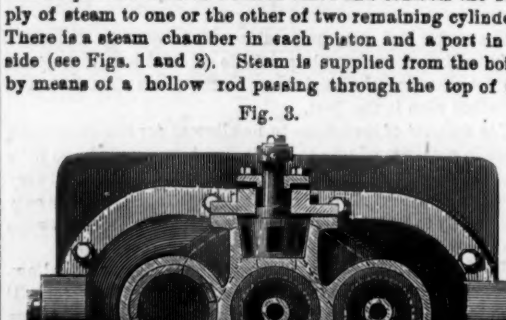
Greenwich, an establishment with which Mr. Willans is connected. In the engine in question three cylinders are used, and each cylinder is single-acting, receiving its steam upon the upper side only of the piston. The connecting rods are attached directly to the pistons, and actuate a three-throw crank shaft.

Fig. 2.



Each piston serves as a steam valve and controls the supply of steam to one or the other of two remaining cylinders. There is a steam chamber in each piston and a port in its side (see Figs. 1 and 2). Steam is supplied from the boiler by means of a hollow rod passing through the top of the

Fig. 3.



cylinder into a steam chest. When the piston has reached about three fourths of its downward stroke, the steam port in it overlaps a port formed in the side of its cylinder, and steam then passes to the top of another of the cylinders; when, on the other hand, the piston has reached about one half its return stroke, it uncovers the port in the side of its cylinder and allows the steam to escape, from the cylinder into which it was previously admitted, into a casing round the crank shaft, from which the exhaust steam is taken either to a condenser or to the air, as the case may be.

In an engine which is required to run only one way round, the port in the side of each cylinder passes direct to the top of one of the other cylinders; but where it is desired to reverse the engine, as in the one illustrated, the ports to the top of each cylinder and those to the sides of each cylinder meet in a three-way cock (see Fig. 2); and this cock, by connecting the port in the side of any one cylinder with that to the top of either one or other of the other cylinders, reverses the engine. It will be seen that the wear upon the connecting rods and crank shaft bearings is always in one direction, namely, downwards, so that no moderate amount of wear affects the working of the engine, and the whole machine is perfectly noiseless. The tubes through the tops of the cylinders, besides forming guides for the pistons, allow a great number of revolutions to be made without any loss of power in stopping and setting in motion again, the amount of dead weight in motion being small; and the pressure upon the three tubes keeps them in equilibrium, but still maintains a constant pressure upon all the bearings. All the lubrication is done through a steam lubricator on the steam chest (Fig. 1), and whatever oil is wasted in the cylinder passes down to the bottom of the casing, and lubricates the lower ends of the connecting rods as they pass round. The upper ends of the connecting rods receive their lubrication direct from the steam chamber in the piston by way of small holes drilled through the bottom of the chamber. As the stroke of the engine is so large in proportion to the width of the steam ports, the latter are opened and closed very quickly, and there is little or no back pressure in the cylinders. By some slight modifications the engine may be made compound, and the crank shaft may, if necessary, be kept outside. A plan of the arrangement is shown in Fig. 3. When there is a casing round the axle, the feed water may be heated by being pumped through pipes passing through that casing.

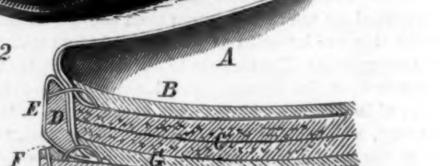
We have examined the engine at work at Messrs. Penn's (says *Engineering*, to which we are indebted for the engravings), and have found it work with admirable steadiness at very high speeds. Some indicator diagrams have also been taken from this engine, showing a very good distribution of the steam. The whole arrangement is, as will be seen, very simple and compact, and there appears to be a wide field for the application of such an engine.

IMPROVED CORK-SOLED BOOTS.

Represented in the annexed engraving is a novel plan for making boots and shoes with cork soles, which, judging from some completed articles which the inventor has submit-

Fig. 1

Fig. 2



ted to us, is an invention both valuable and timely. A very thick but very light sole is provided, which effectually keeps out the cold and wet of winter, and in summer shields the foot from the excessive heat of the sun-baked pavements. The device is as easily repaired as the common sole, and its use in bad or rainy weather would obviate the wearing of overshoes, to most persons a disagreeable necessity

In Fig. 1 a view of the finished boot is given, from which it will be seen that there is no detraction from the neat appearance of the covering. In Fig. 2, a sectional view of the sole shows the mode of attachment of the various portions of the same. The upper, A, is attached to the inner insole, B, by a seam. C is the cork, which is made in two layers, superposed, this construction preventing dampness passing through, however thin the material itself may be. Around the edges of the cork is placed a band of sole leather, D, covered with fine calfskin, E. This cover and the upper edge of the band are sewn in with the upper to the inner insole. By a second seam the upper, the lower edge of band, D, the cover, E, and the welt, F, are attached to the middle sole, G. The upper is taken up in both seams, giving great strength and firmness to the sole. The outer or main sole is secured to the welt by a third seam in the ordinary manner.

Patented through the Scientific American Patent Agency, June 16, 1874, by Mr. E. A. Brooks, of 1,196 Broadway, New York city, who may be addressed for further particulars.

THE BUILDINGS FOR THE CENTENNIAL EXHIBITION.

The Commissioners who have charge of the arrangements for the Centennial Exhibition, to be held at Philadelphia in 1876, have recently given to the public definite details of the buildings to be erected in Fairmount Park for the purpose. The structures are five in number, the Main Building, the Art Gallery, and the Machinery, Agricultural, and Horticultural Halls. We publish herewith views of the first two, which give an excellent idea of their general appearance and proportions.

The Main Building is to be 1,880 feet long and 464 wide, covering 20 02 acres of space. The whole will consist of one floor only, except in the projections and towers, where galleries, giving additional space, will be provided, adding 1 45 acres to the available area. The great length of the building has rendered advisable the breaking of the roof lines by the addition of three transepts or cross avenues. The roof is chiefly of the hight of 70 feet from the ground, the towers at the corners being 75 feet high. The central portion, 184 feet square, rises to an elevation above the rest of the building, and is surmounted by four towers 120 feet high. The central avenue will be 120 feet wide, with another, 100 feet wide, on each side of it. The passages for promenade, between the long lines of exhibited articles, will be mainly 30 feet wide.

The foundations for this structure, which promises to be admirably light and convenient, as well as graceful in appearance, are to be piers of masonry, the superstructure consisting of wrought iron columns, with roof trusses of the same material. The columns are to be of rolled channel bars, with plates riveted to the flanges, and the roof trusses are straight rafters, with struts and tie bars. The columns are to be 24 feet apart; and timber paneling, to the hight of seven feet, is to be filled in between the outer columns. Above the paneling, glass sashes are to rise to the top of the building, portions of the sashes being removable for the purpose of ventilation.

The engineers and architects of the structure are Messrs. Henry Pettit, Consulting Engineer of United States Centennial Commission, and Joseph M. Wilson.

Every product exhibited in any part of the entire Exhibition will be considered as belonging to one of the following ten departments: 1. Materials in their unwrought condition, mineral, vegetable, and animal. 2. Materials and manufactures, the result of extractive or combining processes. 3. Textile and felted fabrics. Apparel, costumes, and ornaments for the person. 4. Furniture and manufactures of general use in construction and in dwellings. 5. Tools, implements, machines, and processes. 6 Motors and transportation. 7. Apparatus and methods for the increase and diffusion of knowledge. 8. Engineering, public works, architecture. 9. Plastic and graphic arts. 10. Objects illustrating efforts for the improvement of the physical, intellectual, and moral condition of man.

In the Main Building will be located portions of all of the above departments, except No. 6, which will be placed in the Machinery Hall, and No. 9, to which the Art Gallery will be especially devoted.

The departments will be arranged in parallel zones lengthwise of the building, the zones being of different widths, according to the bulk of the products exhibited in the particular department. The States and countries exhibiting will be arranged in parallel zones crosswise of the building, these zones also being of different widths, according to the amount of space required for the exhibits of each country. Between each department and each country will be passage ways distinctly marking the limit of each. The result of this dual system will be that any visitor or student, desiring to compare the products of the same kind from different parts

THE ART GALLERY FOR THE CENTENNIAL EXHIBITION.

of the world, may do so by passing through the building lengthwise, keeping in the zone devoted to the particular department; and any one desiring to examine only the products exhibited by any particular country or State may do so by passing through the building crosswise, in the zone devoted to the particular country or State.

THE ART GALLERY

is of a highly ornate design, and is intended to be the best and handsomest building yet erected on this continent for the purpose. It is to be constructed of granite, glass, and iron, and will be thoroughly fireproof. Its dimensions are 365 feet long, 210 feet broad, and 72 feet high, with a dome, surmounted by a figure of Columbia, rising to 150 feet from the ground.

The Central Hall will be 95 feet long, and the Pavilions, one at each end of the building, will be 45 feet. The Pavilions will be connected to the Central Hall by arcades, each 90 feet long by 40 feet high.

The lighting arrangement, the most important point in the construction of an art gallery, appears to be thoroughly efficient. From the east and west sides of the Central Hall extend the galleries, each 98 feet long, 48 feet wide, and 35 feet in hight. These galleries admit of temporary divisions for the display of paintings. The center hall and galleries will, altogether, form one grand hall 287 feet long and 85 feet wide, capable of holding eight thousand persons, nearly twice the dimensions of the largest hall in the country. From the two galleries, doorways open into two smaller galleries, 28 feet wide and 89 feet long. These open north and south into private apartments which connect with the pavilion rooms, forming two side galleries 210 feet long. A corridor 14 feet wide opens into a series of private rooms. Mr. H. J. Schwarzman is the architect, and Mr. R. J. Dobbins the contractor.

It will be seen that the Commissioners have duly appreciated the magnitude of their undertaking, as well as the advisability of appealing to modern taste, culture, and refinement. If these two structures, the erection of which is being vigorously prosecuted, are finished as they are represented in our engravings, and the other three are equally worthy of their noble purpose, we shall, as a nation, have something to be proud of in our Centennial Exhibition, and among our best exhibits will be the buildings themselves.

THE FRANKLIN INSTITUTE EXHIBITION.

No. II.

PUMPS.

The huge water tank in the southeastern corner of the building attracts crowds of visitors. Clustered around it is to be found almost every variety of steam and hand pump. All the steam pumps are in operation, and together discharge immense quantities of water. Among the exhibitors we notice Potter & Hoffman, C. A. Conde & Co., William Cramp & Sons, Henry C. Hall & Co. (pulsometer pumps), Cooper, Jones & Cadbury, J. H. Billington & Co., and last, but not least, Thomas Shaw. The pump shown by this gentleman is one of the largest ever exhibited, and deserves especial notice. He calls it a compound propeller pump, and he claims for it especially simplicity of construction: it contains no valves, and consists essentially of but three pieces, namely, the column pipe, shaft, and propeller; therefore it is economical, costing much less than any other equally powerful pump. Its enormous power is a feature peculiar to it. The one exhibited is a 20 inch pump, and lifts 10,000 gallons per minute; with a greater speed it can lift 14,000 per minute. A 7 inch pump yields 1,000 gallons, and an 8 inch pump, 1,200 gallons, per minute. It can be used either as a force or a lift pump; can be placed at any angle; will lift sand, mud, sticks, and dirt off sunken lands without serious hurt. The hight to which the water can be lifted depends only upon the power employed. A serious difficulty was at first experienced in obtaining a bearing suitable to sustain without injury the enormous weight of the column of water, together with the shafts and propellers. This has, however, now been successfully met by Mr. Shaw's effective water bearing, which consists essentially of a cast iron beam resting on the top elbow of the pump, upon which pillars are secured, supporting a stationary disk carrying an ordinary stuffing box, penetrated by the propeller shaft. A dome rises from the stationary disk, and inside of this a second disk is attached to the propeller shaft and revolves with it. Water is forced below these two disks, under a pressure equal to the weight sustained. In this way the entire weight of the revolving machinery and the greater part of the water column is supported on a film of water on which the revolving disk floats. When too much water is forced between the disks, the revolving disk is raised and the surplus allowed to escape. The water is raised into a large tank 16 feet long, from which the water falls 10 feet to the tank below. The pump is driven by a beautiful engine built by Neafie & Levy, of Philadelphia.

IRON AND STEEL.

The Union Iron Company of Buffalo exhibit a heavy 15 inch beam weighing 66$\frac{2}{3}$ pounds per foot, 52 feet 6 inches long, rolled in one heat; and a light 15 inch beam, weighing 50 pounds to the foot, 60 feet 6 inches long, also rolled in a single heat.

The Midvale Steel Works, of Nicetown, Philadelphia, make a beautiful display of their manufactures of cast steel. Several cold twisted rails are exhibited, showing the excellent quality of the steel. Forgings of various forms are also to be seen. A steel axle made of Siemens Martin steel was submitted to the following tests: A weight of 1,640 pounds, falling 20 feet, was allowed to fall on the bar, placed on bearings three feet apart. The bar was reversed after each blow. The following deflections were observed: The first blow produced a deflection of 7 inches; the second, of $\frac{7}{8}$ inch in the opposite direction; the third, 6$\frac{3}{8}$ inches in the opposite direction; the fourth, $1\frac{3}{16}$ inches; the fifth, 5$\frac{1}{2}$ inches and the sixth, 2$\frac{1}{2}$ inches, each in the opposite direction.

HEATERS AND STOVES.

In heaters and stoves a very large display is made. Liebrandt & McDowell exhibit, among other novelties, the Radiant Parlor Cook, Our Mutual Friend, and the Great Centennial Range. Samuel Kirby exhibits the Phœnix Double Heater, which he claims to be one of the most economical and powerful now in use. A small grate attachment serves as a consumer in cleaning clinkers from the fire. J. A. Lawson exhibits a combined self-feeding and surface-burning furnace, called the Pearl. It is designed especially for the consumption of anthracite. Other firms are adapted to bituminous coal and wood. Fuller, Warren & Co. exhibit a very beautiful open front Franklin stove, which they call the Howard. The cheerful, open fire is combined with economy and cleanliness. The Pennsylvania Heating and Ventilating Warehouse and Blacksmithery Works, of Philadelphia, exhibit one of D. Mershon's Sons' wrought iron airtight furnaces, adapted for all kinds of fuel. A novel application of a regulator is made, by which the fire can be regulated without going into the cellar. This is effected by simple levers and pulleys. Reynolds & Son, of Philadelphia, exhibit their wrought iron airtight furnaces. Among a number of forms we note especially the Centennial Furnace, arranged expressly for burning bituminous coal or coke.

MACHINE TOOLS.

Unquestionably the most interesting feature of the Exhibition is the display of machine tools. Among the prominent exhibits we notice those of the following firms: William Sellers & Co., W. B. Bement & Son, Van Haagen, Shoper & Bro., Faris & Miles, E. Harrington & Son, and many others. As it will be impossible in the limited space of a single letter to do justice to all these exhibits, we therefore select one of the most prominent, namely, that of William Sellers & Co., of Philadelphia. Among the many ingenious tools exhibited by this firm none attract more attention, both from experts and non-experts, than their automatic gear cutting and wheel-dividing machine, and indeed justly so, for it is a marvel of ingenuity. Its movements are entirely automatic, no manual labor whatever being required on the part of the operator, save the oiling of the machine. It is impossible to convey a clear idea, in a brief description, of the number of beautiful motions of the machine. The gradual advance of the cutter, its quick return and final stop, the automatic starting of the dividing mechanism which brings the wheel around to the exact position for the next tooth, must be seen to be fully appreciated; and when once seen, there is a kind of fascination about it that makes a visitor spend a length of time in examining its beauties.

Alongside of the gear cutter is one of their self-acting slide lathes for turning and screw-cutting, the arrangements of which secure great convenience for working. The top of the shears is a plane surface. The saddle carrying the slide rest is guided on the front edge, the heads moving between the parallels. The cone pulley is furnished with five steps, giving fifteen rates of speed, rising proportionally from the slowest to the most rapid. The feed movement is especially novel. By means of an ingenious combination of friction disks, invented and patented by Mr. C. Sellers, the rate of speed is altered by the simple turning of a milled screw, no stoppage or change being necessary. The importance of this feature will be instantly recognized.

A nut shaper of entirely new design is also on exhibition. All six sides of the nut are finished at the same time, by means of a peculiar arrangement of cutters. A continuous stream of oil is supplied, to the surfaces cut, by a pump beneath, run by the machine. Nuts finished by this machine have a beautiful and characteristic appearance imparted to them. We also notice a radial drill, with adjustable arm capable of a five foot swing. The tool is so arranged that the spindle can be accurately adjusted to any point of the lathe, thus avoiding the moving of heavy work. A section of the latter is susceptible of vertical adjustment, thus adapting the machine to the performance of small work. The spindle is driven by a belt running horizontally, giving the remarkably smooth motion so characteristic of the Sellers' upright drills.

Another interesting feature of their exhibition is a lathe in which are two small grinding machines, one for drills and the other for straight edges and other hardened work requiring true surfaces. The drill grinder produces the required edge on the drill with no other labor than is needed to set it in the required position. Though a small tool, it deserves especial mention. The slotting machine is also remarkable for the originality and excellence of its construction. A vertical adjustment to the connection of the slotting bar enables it to be easily set for different hights of the work. The feed movements are readily controlled by the workman, without leaving a position favorable for watching his work. A number of other novelties are exhibited by this firm, among which might be mentioned their improved forms of Gifford injectors for feeding boilers, but want of space prevents any further notice.

Messrs. Riehle Brothers make a fine display of their scales and testing machines. They have on exhibition one of their 75 tuns upright testing machines for ascertaining the tensile strength of round, flat, or square specimens of any material from 18 to 32 inches long; also one of Professor Thurston's new testing machines.

Fairbanks & Ewing, of Philadelphia, have on exhibition a large number of their standard scales for different purposes, as well as scales graduated to the Russian, French, Chinese, Spanish, and other standard scales. Messrs. Howe, Fairbanks & Co. also make a fine display.

As an unusually fine specimen of wood work, we note the Union table, made by Samuel McCracken, of Philadelphia. It contains some 35,000 pieces of wood. Among the varieties employed are the following: oak, pine, walnut, coco, tulip, amboyna, lance, locust, mahogany, Hungarian and American ash, cedar, white holly, French walnut, satin, and rose. The American eagle is in the center, surrounded by thirteen stars, and in circles beyond this are stars and other devices. On the whole, the effect is a happy one.

A Bullock printing press and a machine for making envelopes, both in actual operation, draw large crowds of the curious. Working models of Chambers' and of the Excelsior brick machines are also exhibited.

The exhibition of drugs, dyestuffs, and chemicals is one of the most attractive features of that portion of the building on the left hand side of the main entrance. The Pennsylvania Salt Works, Powers & Weightman, Henry Bauer, John Lucas & Co., Harrison Brothers, and Rosengarten & Sons have exceedingly large displays.

Sheet Iron Gas Mains.

The Paris Gas Company have lately laid down a main 3·2 feet in diameter and 1,093 yards in length, from St. Maude to the Place du Trône. Hitherto sheet iron pipes covered with bitumen have not been applied to mains of that dimension, and it was important to ascertain how such pipes of a moderate thickness would answer beneath the public roads, where they would be submitted to the permanent and accidental pressure tending constantly to produce deformity.

The company had already adopted sheet iron pipes of 27·55 inches diameter, without any important deformity being produced, and it was only necessary to submit the 3·28 inches pipes to similar pressure to ascertain what effect it would produce, all theoretical calculation being deemed untrustworthy. A comparative trial was therefore made with the aid of an apparatus planned for the special purpose. A pipe of 27·55 inches diameter, of the ordinary thickness of 0·157 inch, and a pipe of 3·28 feet diameter, 0·197 inches thick, were laid in the ground in the mode adopted for the mains in Paris, the trenches having been dug in such a way that there was a space of 10 inches between each side of the tube and that of the trench, and that the filling-in above each pipe should be 3·28 feet in depth. The pipes in ordinary use are 13 12 feet in length; but in order to spread the weight over a large surface, pipes 19·68 feet long were adopted for the experiment, and one end of each was left open to allow of access to the interior.

The trial was made by placing on the soil above them pigs of lead, from four up to twenty tuns weight, which were supported on a platform composed of timber, and having a surface of 86 square feet. This platform was laid upon two pieces of timber, each 19 7 inches long and 9 85 inches wide, and placed 6 90 feet apart, which represented the tyres of the two wheels of one of the axles of a locomotive of forty tuns. The apparatus for the indication of the deformities produced consisted of a circular disk of sheet iron with nine radial rods, each supported by two small guides screwed to the disk, and provided with a spiral spring which kept its outer end pressed against the inner surface of the pipe. The guides of the rods were each provided with a set screw to hold the latter in place while the apparatus was being placed in the pipe. The only object of the rods at the lower part of the disk was to maintain the center of the latter in the axis of the pipe, and when the apparatus was in place both the guides of these lower rods were screwed firmly to the disk. Thus any alteration in the vertical diameter was measured from the center. In the center of the disk was an opening 7 87 inches in diameter, fitted with a piece of iron covered with leather, which carried a circular piece of paper. Each iron rod on the upper part of the disk was fitted with a pointer held in a small tube by a spring, and provided with a copper button. When the apparatus was in its place a finger was pressed on each button, and the position indicated by pricking through the paper, the leather behind preventing the point of the needle being turned. When a load was laid on the platform above, the position of the pointers was again pricked through the paper, and the difference between the two marks showed the amount of deformity produced. The results obtained were then transferred to a diagram of the same section as the pipe itself.

By comparison of the diagrams obtained, it was found that, with a load of twenty tuns pressing on the pipes for 130 hours the 3·28 feet pipe had given way vertically to the extent of 2·85 per cent, and the smaller pipe of 4·30 per cent. The conclusion was that a pipe 3·28 feet in diameter and 0·197 inches thick offered greater resistance than a pipe 27·55 inches in diameter and 0·157 inch in thickness, which had already proved itself satisfactory in practice. It was found by further experiments that, when a pipe had once been deformed by a heavy load, it only recovered itself to the extent of a fraction of an inch when the load was removed. After these experiments a main 3 28 feet in diameter was laid from the gas works at St. Maude to the Place du Trône, and as the joints were made they were tried with compressed air under a pressure of 2·755 inches of the mercury manometer, the pipes themselves having been previously tested under a pressure of 75 pounds to the square inch. These trials revealed a few defects which were easily repaired. Since that time the main in question has been in use constantly, without exhibiting anything contrary to the results of the several experiments which we have above recounted.—*The Engineer.*

Etching Iron.

Much time and attention has been devoted by Professor Kick, of Prague, to the subject of etching iron with acids. His method is not a new one for arriving at a knowledge of the quality of iron or steel, having been used with some success for a long time, but the care with which the professor has conducted his experiments makes them exceedingly valuable.

Some kinds of iron exhibit what is known as the passive state, and are unacted upon by acids until this state has been destroyed by heating. The surfaces thus prepared were inclined to rust very soon. After a series of experiments with nitric, sulphuric, and hydrochloric acids, and etching solutions of copper salts, Professor Kick found that a mixture of equal parts of hydrochloric acid and water, to which was added a trace of chloride of antimony, was the best etching solution. The chloride of antimony seems to render the iron less inclined to rust, so that, after washing thoroughly in warm water, and applying a coat of dammar varnish, the etched surface may be kept quite clean.

The smooth surface that is to be etched is surrounded with a ridge of wax an inch high, as is done in etching copper plates, and the acid is poured into the dish thus formed. At a temperature of 55° to 63° Fah., the action soon begins, as shown by the gas evolved; in winter the etching is poor. The time required is from one to two hours, but the etching should go on until the texture is visible. Every half hour the acid can be poured off without removing the wax, the carbon rinsed off, and the surface examined. If too much chloride of antimony is added to the acid, a black precipitate will soon form, which can easily be distinguished from the carbon. One drop of chloride of antimony to the quart of acid is sufficient. When the etching is finished, the wax rim is removed, the iron washed first in water containing a little alkali, then in clean water, brushed, dried, and varnished. If in a few hours it begins to rust, the varnish should be removed with turpentine, which will also take off the rust, and then varnish again.

The appearance of different kinds of iron when etched is essentially as follows: Soft or sinewy wrought iron of excellent quality is attacked so equally by the acid, and so little carbon is separated, even after several hours' action, that the surface remains bright and smooth. Fine grained iron acts the same; the surface is still smoother, but a little darker. Coarse grained and cold-short iron is attacked much more violently by acid than the above. In ten minutes, especially with the latter, the surface is black. After thirty minutes a black slime can be washed off, and the surface will remain black in spite of repeated washings, and exhibits numerous little holes. Certain parts of the iron are usually eaten deeper, while others, although black and porous, offer more resistance. By allowing the acid to act for an hour or so, then washing, drying, and polishing with a file, a distinct picture is obtained. Malleable cast iron, we know, rusts more easily than wrought iron, and it is interesting to know that the action of acids is also violent, the surface being attacked very violently. Gray pig iron acts like steel; the etched surfaces have quite a uniform gray color. In puddled steel, the color, after etching and washing, is gray, with quite a uniform shade, and the lines are scarcely visible. Cement steel has a very similar appearance, the lines being very weak. In Bessemer and cast steel the etched surfaces are of a perfectly uniform gray color, with few, if any, uneven places. The softer the steel, the lighter the color.

On etching, the finest hair-like fractures are rendered prominent. A piece of steel, which looked perfect before etching, afterwards exhibited a hair-like fracture throughout its whole length. When different kinds of iron are mixed, the acid attacks that for which it has the greater affinity, while the other is less acted upon than if it were alone. Etching is exceedingly valuable to all who deal largely in iron, as it enables them to determine with comparative accuracy the method of preparing the iron, as in the case of rails, etc., as well as the kinds employed.

New Phosphor Bronzes.

Dr. Kunzel, whose name will be recalled as the joint discoverer, with M. Montefiore-Levy, of the well known phosphor bronze, now announces the additional discovery that when phosphor bronze is combined with a certain fixed proportion of lead, the phosphorised triple alloy, when cast into a bar or bearing, segregates into two distinct alloys, one of which is hard and tough phosphor bronze, containing but little lead, and the other a much softer alloy, consisting chiefly of lead, with a small proportion of tin and traces of copper. The latter alloy is almost white, and, when the casting is fractured, it will be found nearly equally diffused through it; the phosphor bronze alloy forming, as it were, a species of metallic sponge, all of whose cavities are occupied by the soft metal alloy segregated from it. This phenomenon of the segregation into two or more alloys of combinations of copper with tin and zinc has long been known; and from the fact that such separation is generally massive, and not equable throughout the mass, it has been a source of great annoyance to the founder. Dr. Kunzel, however, seems to have succeeded in causing the segregation to take place in uniform distribution throughout the casting, and has taken advantage of the properties of the product, which he obtains in this manner, to construct therefrom bearings of railway and other machinery.

In heavy bearings, such as those for marine engines, the valuable properties of Babbitt metal, and similar anti-friction alloys, are well recognized; but these, being generally soft, are open to the grave objection that, where they are subjected to considerable pressure, or even moderate pressure accompanied by continued vibration, they become distorted in form, and then fail to sustain the journals in their proper places. The device is, therefore, resorted to by the machinist of casting a hollow cage of hard metal, of proper form for the intended bearing, the cavities of which he then fills up by casting into them the soft metal alloy, which thus forms the actual rubbing surface of the bearing. The hard metal cage thus supports the soft metal within, and prevents its distortion or escape, save by surface abrasion. Dr. Kunzel claims to effect the same result by the peculiar constitution of his new phosphorised alloy for bearings. This forms its own supporting cage for the soft bearing metal, which, as alluded to at the outset, separates from it in the process of cooling. He claims that these bearings combine the very small friction and non-abrasion of the journals with the firm resistance to pressure and stability of form of bearings of hard metals. The test of practice, however, alone can decide the value of these claims, though they seem very plausible.—*Iron.*

The Waste of Power in Cotton Mills.

The winter session in connection with the Manchester, Eng., Scientific and Mechanical Society was lately opened by a paper by Mr. Evan Leigh, C.E., on the waste of power in cotton mills.

During the course of his paper, Mr. Leigh said that it might naturally be thought that England would not allow herself to be surpassed by any foreign country on any point relating to her principal and favorite manufactures. On one or two points, however, England has been most decidedly excelled by inventions originating in America. He alluded to ring spinning and belt driving, both of which were eminently calculated to save power, and consequent waste of fuel. Referring to ring spinning, he said that it had been introduced into England as an American invention more than forty years ago, but for some reason it was not generally adopted by the English spinners. Perhaps that was owing to the recent failure of the Danforth throstle, another American invention of great promise, that had been adopted by several spinners. Although the principle of the two frames was totally different, the English spinner was not to be caught again, so he fought shy of the ring frame, and it was believed that for more than thirty years not one frame on that principle was used in Great Britain. The solid advantages of this method of spinning were, however, duly appreciated in America, and the system was cultivated until the difficulties and exact mechanical requirements attending its construction were thoroughly mastered, and the result was the production of a frame that took only half the power of an ordinary flyer throstle, besides being capable of working practically at a much higher speed. At the Laconia Mill, Biddeford, Me., Mr. Leigh saw, last year, a girl minding, apparently with ease, 1,344 spindles of these frames, with the front rollers running seventy revolutions per minute, spinning No. 26 yarn, and found it quite common for such piecers to run 1,100 or 1,200 spindles with so little hurry that they had plenty of time to avail themselves of a seat which was provided for each spinner, on which she sat and leisurely watched the frames spin. He (Mr. Leigh) did not think that this arose from superior ability in the American, but simply that in foreign countries spinners are less jealous of one another, and band themselves together to discuss and test scientifically all alleged improvements.

In Boston, Mass., the Cotton Manufacturers' Association had a semi-annual meeting, at which papers were read relating to new inventions in cotton spinning and manufacturing, and a discussion followed, in which each related the results of his own experience in testing any invention in question. In that manner, every particular subject was thoroughly ventilated, and the truth arrived at, establishing a safer basis for the investment of capital than would otherwise be the case. Should opinions be divided as to the merits or demerits of a new thing, the question was adjourned to the next meeting, and, if need be, a number of experts went round to the different mills and tested the machine in question impartially, by the results produced and power consumed, which were carefully measured by the dynamometer. A report followed, and another meeting generally settled the point.

Going on to speak of the comparative advantages of belts and gearing, Mr. Leigh said that the proper application of driving belts to the machinery was a most important question. To be rightly applied, a main driving belt should move through 4,000 or 5,000 feet of space per minute, and be sufficiently wide to drive all the machinery and shafting quite easily when running in a slack state. After a new belt had been once tightened up, it should work many years without wanting any further tightening, and would do so if made of good material and properly applied, saving in the meantime a large amount of power and all the grease and labor of putting it on, to say nothing of the noise heavy gearing makes. The speaker then adduced some practical instances of the extent to which belt power might be used in connection with machinery, giving examples from the various mills he had visited in America, showing the durability and ease with which large belts did their work. The lesson taught by the big belt was imperative, namely, that there should be very light shafting run at a very high speed, with larger drums and pulleys; then very little would be heard of strap-piecing, or wear and tear of belts, working with less power and steadier production all the while. The simplest and best, and also the cheapest and most durable, method of driving by belt was to convey the power from the main driving shaft direct to each room by a separate strap, and, if more than one shaft was wanted in any room, to drive it from the other direct by a separate strap, apportioning the width of each strap to the power it was required to drive, and, whenever a belt was necessarily short, allowing a little extra width.

Schools for Engineers.

Within the past ten years, schools for engineers have increased rapidly in this country. They are, to speak exactly, eclectic schools, where most of the positive and some of the abstract sciences are made a part of the regular course. They are not purely theoretical in their instruction, but have workshops attached, wherein the usual tools of a modern machine shop are found, and where substantial work is undertaken and subsequently sold in open market in competition with that of the trade. These schools or colleges have teachers thoroughly skilled in their professions, many of them being themselves graduates of machine shops in the most honorable and praiseworthy sense, who have from humble beginnings raised themselves to posts of importance and responsibility. Associated with these men are others of special prominence in the sciences they preside over, so that, by the union of practical example and pure theory, a student may graduate from any branch of science he selects.

It is scarcely necessary to say that such schools are of the very greatest importance to the country; and in view of this fact, it is proper to remind young men that engineering, which is largely and carefully taught there, is a profession which greatly needs thoroughly educated men. There cannot be too many in it, for the future of this country is so vast, its resources so utterly undeveloped, that there will be need of all who have fitness for engineering pursuits. Civil, mechanical, mining, hydraulic, and architectural engineers will be in demand in the future, and will find ample room for the exercise of their professions without interfering with one another. Nowhere can they find better facilities to become acquainted with the best modern practice of their callings than in these industrial schools. The ordinary colleges afford no such advantages as can be obtained at Cornell University and the Stevens Institute of Technology at Hoboken, and some others. These are well appointed establishments, with complete workshops, where Science and the practical development of it go hand in hand; where the natures, peculiar qualities, and modes of working various metals are shown in processes carried on by the student himself: not with a view of dabbling in the pursuit as a sort of experiment or recreation from dryer studies, but to produce works which are valuable.

Professor Sweet, of Cornell University, for example, sent out at one time circulars of face plates, straight edges, and angle plates of guaranteed excellence and accuracy, all of which were offered at low prices and made at the University workshops. It is notable also that, in the Stevens Institute of Technology, for example, the terms for a course of any branch are so low as to be almost nominal. By the munificence of Edwin A. Stevens, who left a large sum of money to found the Institute, residents of New Jersey are received as pupils at $75 per year for instruction only, and non-residents at $150. With such facilities, it is to be hoped that the rule-of-thumb engineers will gradually become extinct, and their places supplied by men who have a reason to give for their opinions, and can tell why they make a piston rod six inches in diameter, or why they sink shafts where there are no surface indications to warrant them in the outlay.

The men who practised their calling without a thorough education in it were pioneers in the profession, and are entitled to respect and consideration for their eminent services. Where there was no thoroughfare, they boldly made one; where there were no precedents, they made precedents; they were a law unto themselves, and by their native talent and sagacity established works which more timid men would never have undertaken. They made few costly mistakes; and though they may have used a few tuns too much of iron or other material, it was cheap in the end, and experience has to be bought in some shape. Now, however, that a more perfect and direct road to the acquisition of professional knowledge is open through these industrial colleges, it will be the fault of parents and guardians if the coming generation does not reap the benefits of them.—*New York Sun.*

Effect of Ammonia Fumes on Flowers.

Professor Gabba has been examining the effects of ammonia on the color of flowers. It is well known that the smoke of tobacco will, when applied in sufficient quantity, change the tint of flowers; but Professor Gabba experiments by pouring a little ammonia liquor into a saucer and inverting a funnel over it. Placing the flowers in the tube of the latter, he finds that blue, violet, and purple colored blossoms become of a fine green; carmine and crimson become black; white, yellow; while particolored flowers such as red and white are changed to green and yellow. If the flowers are immersed in water, the natural color will return in a few hours. Professor Gabba also found that asters acquire a pleasing odor when submitted to the fumes of ammonia.

A NEW potato, known as the white queen (*reine blanche*) is being cultivated in France. In good soil, from ten to fifteen tubercles are formed, many of which attain or exceed the weight of 2·2 pounds. The flavor is said to be very fine. Planted in February or March, it becomes ripe in July.

Engineering learns that a rolling mill at Columbus, O., has recently contracted to furnish a large quantity of rails to a railroad company at $52 per tun. This is said to be $3 per tun less than the price at which the same quantity of rails could be delivered from England to the same part of the United States.

Recent American and Foreign Patents.

Improved Latch.

Edward Halsey, San Jose, Cal.—This invention consists in a pivoted and handled gravity latch, provided with a projecting pin or lug, and so attached to a gate adapted to swing in either direction laterally that, when the gate is being swung shut, said latch will turn on its pivot, and the pin or lug ride up one of the inclines of a striker plate, which is fixed to the post, and engage a notch formed therein.

Improved Seamless Rubber Nipple.

Charles B. Dickinson, Brooklyn, N. Y.—This invention relates to the seamless rubber nipples employed upon the mouth and neck of bottles from which infants are expected to suck some liquid nourishment, and consists in an improved construction whereby they may be more conveniently cleaned out by a swab, may be more quickly taken from the mold, and be able to shut out or exclude all passage way for the air when the child bites or closes its gums upon it.

Improved Process of Treating Natural Oils.

Julius Schubert, Parkersburg, W. Va.—This invention consists in combining, with a vessel in which oil is to be purified by the action of hot water, of a heating coil having an exit pipe for any steam that may be generated. This simple improvement enables the imparted heat to be restrained within a degree of temperature that will not injure the oil, while the impurities are precipitated with equal certainty.

Improved Car Coupling.

John Carpenter, of Mariner's Harbor, N. Y.—The coupling link engages with jaws on the ends of two levers. The drawhead is made in two parts. The levers extend back between the parts of the drawhead, and are held together by springs. The jaws lap past each other; but a space is left between the levers, in which is placed a spreading bar. This is on a horizontal rod, which passes through the drawhead. On the ends of the rod are levers, attached by square sockets, by means of which the rod and opener are turned for spreading the jaws and uncoupling the cars. The coupling link has springs, which allow it to be varied from the horizontal in either direction, up or down or laterally, as may be necessary, in entering the mouth of the opposing drawhead.

Machine for Burnishing the Edges of Boot and Shoe Soles.

Levi Hussey, New York city.—This is a machine for burnishing or polishing the edges of the soles. The improvement consists in a gage which may be adjusted according to the thickness of the sole, and held in position by a screw rod which works through a stand. A spiral spring takes up any slack of the screw, and always holds the gage evenly up to the polisher.

Improved Raker and Loader.

Samuel D. Muse, Monticello, Miss.—This is a rake on a wheeled truck, combined with a vehicle having a rearwardly tilting body, the former being movable within the body of the latter. The object is to provide a simple and efficient means for gathering pine straw to be used as a fertilizer.

Improved Reed Organ Attachment.

Simon B. Shoninger, New Haven, Conn.—A *voix celeste* stop draw connects with mechanism so as to slightly raise the bar of the octave coupler, so that when a key is pressed down it will slightly open a valve of the octave below, giving the reed just enough air to sound, but not quite on the same pitch as when the coupler stop is drawn out. The coupler bar is divided so as to operate both sections when the lower section is used, but enabling the upper to be operated singly.

Improved Car Coupling.

Gilman H. Ames, Fort Fairfield, Me.—In this invention, the drawhead is provided with an upper and lower chamber, in the upper one of which is a coupling bar having lateral projections which secure it to the drawbar. These projections work in slots in the sides of the drawbar, which have an upward and somewhat receding direction. The coupling bar within the head of the drawbar rests on hook-shaped feet. The slots in the drawhead, in which the projections on the coupling bar work, serve a fourfold purpose, namely: 1. They let the bar rise to allow the coupling bar of the opposite car to pass under the outer hook, the said hook immediately dropping down into the slot in the end of the approaching car. 2. They give the bar a tendency to draw downward, thus preventing the cars from being casually uncoupled. 3 They allow the draft to be raised to fit higher cars of the old style. 4. They give the bar a receding motion when it comes in contact with obstacles, thus breaking the force of the collision. In the lower chamber is a link, fastened by a pin, to adapt the same drawbar to be used with the ordinary drawbars.

Improved Stocking Supporter Clasp.

Rachel Eberle, New York city.—This invention applies specially to a catch which takes hold of the stocking, which catch is attached to the end of the supporting strap. Button holes in the top of the stocking are thus obviated.

Improved Sofa Bed.

William Livingstone, Springfield Store, N. Y., assignor to Denzer, Medicus & Co., New York city. This is a movable head piece of the sofa or lounge, which moves in suitable supporting slides on the main frame, and gives a rigid support to the hinged section when thrown open. The intermediate space between the head piece or back is provided with flexible bands, which are stored into a recess of the back and covered by a pivoted face piece.

Improved Washing Machine.

William Hilton, Agency City, Iowa.—Half bearings rest upon the journals of the roller. Upon guide pins attached to said bearings are placed coiled springs. The upper ends of said pins pass up through ends of a wooden spring, to the center of which is attached a guide pin, upon which is placed a coiled spring. The upper end of the pin passes through the center of another wooden spring, which rests upon the coiled spring, and the ends of which pass through slots of the standards. Several holes are formed in the standards to receive holding pins, so that the tension of the springs, and consequently the pressure upon the clothes, may be regulated at will.

Improved Screw Press.

Cyrus W. Crenshaw, Athens, Ala, assignor to himself and J. M. Townsend, same place.—The screw has a semicircular groove. The nut also has a semicircular groove, instead of the usual thread, and, besides, has a circular spiral channel connecting each end of the spiral groove, which has a hollow spiral flange to provide for the passage. Balls, with which the spiral groove and the return channel are filled, form a continuous row on which the screw rolls, instead of sliding on threads, to lessen the friction. When the screw turns downward, the balls roll down into the channel and return to the top of the nut, those being forced down by the screw pushing those in the channel up to the top; and when the screw turns upward, the balls roll up in the groove and pass down in the channel.

Improved Quilting Attachment for Sewing Machines.

William B. Null, Standiosville, Ill.—The quilting rollers are arranged in a beam, so that they can be readily lifted out of their bearings, and the hangers of that beam are so pivoted to the frame that the beam can be readily swung up to pass over the head of the sewing machine to allow of passing one of the quilting rollers under the arm and behind the needle bar and presser. The friction is applied to the quilt rollers by the lever, tightening pulley, and belt, and the pulley has teeth working in holes in the belt, and also a dividing wheel on its axis to govern the shifting of the quilt on the rollers for graduating the spaces between the seams, by means of arms on the wheel, and a stop spring for arresting and holding the wheel.

Improved Needle Threader.

John M. Stamp, Washington, D. C.—The object of this invention is to provide a means of easily threading the needle of a sewing machine. It consists in the peculiar construction of a hook which passes through the eye of the needle and seizes the thread, the said hook being attached to a shank, which is of a size barely small enough to allow its passage through the eye, and the hook being so cut away on both sides as to reduce the thickness to that of a knife's edge, so that the thread will bend short and to a point around the edge, and also have room to flatten itself on the sides of the hook when passing through the eye of the needle.

Improved Cotton Scraper.

William Sandlin, Minden, La.—This scraper, the lower edge of which is so formed as to fit upon the colter of the plow, is provided with two lugs, one of which rests against the land side of said colter, and the other upon its upper side. The scraper is so formed as to guide the soil and weeds removed by it back to the mold board of the plow, along which they pass, and are covered by the soil. Upon the rear end is formed a shank, which extends up to the plow beam, and may be secured to it.

Improved Sun Dial.

David B. Scofield, Auburn, Oregon.—This is an adjustable, pivoted, graduated sun dial, having the upper edges of the meridional gnomon straight, and a northern face provided with beveled edges, and graduated to denote the time upon the face.

Improved Middlings Purifier.

John T. Wright, Richmond, Va., and Elkanah Bateman, Howardsville, Va.—This invention relates to certain improvements in middlings purifiers. It consists in the combination of a polygonal reel having bolting cloths of different degrees of fineness and ribs attached forming buckets, with the diagonally set vanes of a fan by which a blast is made in the direction of the vent. It consists further in the arrangement of a suction fan and roof in the top of the casement and a compartment in the end of the same, whereby the lighter and more worthless particles of the middlings are separated from the heavier grains, and the latter left in a better condition for regrinding.

Improved Life Preserving and Diving Apparatus.

John P. Schmitz, San Francisco, Cal.—This invention relates to certain improvements in life-preserving and diving apparatus. It consists in the peculiar construction of a floating air receiver in combination with an elastic hose, and also in the combination with said elastic hose of sectional metallic tubes for the purpose of preventing the collapse of the hose when subjected to the pressure of the water.

Improved Lubricating Compound.

Charles F. Benedict, Richmond, Va.—This invention consists in a process of preparing a lubricating grease for car axle journals by first boiling oil or fatty matter until it loses its spongy appearance, next boiling the resultant in a solution of soda and carbonate of lime until it saponifies and thickens up, and finally passing it through a grinding mill: also in a new article of manufacture consisting of saponified axle grease or lubricant of a waxy consistency.

Improved Fifth Wheel.

Paul La Belll, Monroe, Iowa.—This invention relates to certain improvements in fifth wheels, designed to dispense with the use of kingbolts and perch plates, and make a neater finish. It consists in an upper plate having a flange bent around for the double purpose of forming a guide and a stop.

Improved Clothes Wringer.

Leander Becker and Stephen M. Smith, York, Pa.—This invention relates to certain improvements in the construction of wringer frames. The improved frame consists of three pieces: the piece forming the bearing of the lower roll, the piece forming the bearing of the upper roll, which is pivoted to the first piece, and a third centrally pivoted lever, at one end of which is a clamping screw for attaching the wringer to the tub, and at the other end a rubber spring that bears against the middle of the piece forming the bearing of the upper roll, by means of which arrangement the pressure of the rolls is regulated by the clamping screw.

Improved Pocket Book.

Gabriel Jasmagy, Brooklyn, N. Y.—This is a pocket book, the partition or pocket part of which is attached to the gussets by means of an interior lining of the latter, provided with as many projecting loops of a band or strip as there are partitions of the pocket book. These are drawn through slits of the lining, and pasted between the double partition walls.

Improved Machine for Mining Coal.

Michael Wright, Clinton, Pa.—In this device the stock will turn on its fastening screws, and the drill on the trunnions, so that a hole may be bored in almost any direction. The operating crank is made in two parts, so that it can be lengthened or shortened to adapt it to the strength of the operator. This machine is especially designed to be operated by hand, but other power may be applied.

Improved Car Axle Box and Lubricator.

John M. Brosius, Richmond, Va.—This invention consists in the journal gate with excisions at the lower end, and placing in the guide groove the triangular blocks or inclined strips, so that the gate does not require to be held by hand, wedge, or other device, but will rest in position until the journal is inserted in the box, and then rise as the journal is pressed inwards: also in forming a box or projecting plate on the inside of axle box, and at the end where the journal enters, so as to prevent the lubricant from being splashed out at the joint: also in making an annular recess or groove in the axle, and near the journal, for the purpose of receiving an elastic ring that serves to form a packing to prevent the escape of the lubricant, and to exclude grit and dirt from working into the axle box: also in making the piece that is intended to hold the lubricating fabric up to the journal of a single longitudinal metallic plate spring, so that it may be readily bent to accommodate itself to any inner conformation of axle box, be easily fastened by the screw in front, and be prevented from lateral play by a simple plate or cross bar which may have a turned-up end. In order to cause the lubricating fabric to slide readily with the journal in passing from one gage of road to another, it is attached to a piece or holder which is slotted, with subjacent dovetail tenon, and thus allowed to slide within the dovetailed groove or channel of the bent plate. It also consists in pivoting the latter on a crosspin in lugs of the spring, so that the fabric will automatically adjust itself to and bear always along the whole length of the journals.

Improved Railway Switch.

Nathan F. Carter, Orford, N. H.—The object of this invention is to cause the switch to be automatically shifted in advance of the engine by a device on the engine under the control of the engineer. The switch rails are connected to a switch bar, to which is applied a toothed rack, with which a segmental wheel gears to shift the switch rails forward and backward, the said wheel being geared with a toothed bar for being turned by it. This bar extends along the track each way from the switch a suitable distance for being worked by the locomotive, and it gears at each end with upright shafts. Each upright has an arm, with one of which a cam on the locomotive is to come in contact as it advances toward the switch to set the bar in motion for shifting the switch. The switch bar carries a locking bolt which drops into a hole immediately after the rails have been shifted to hold them fast while the cars pass, and arrangements are provided which afterward lift the bolt out and free the switch.

Improved Water Elevator.

Edemon P. Le Blanc, Houma, La.—This invention consists of a series of buckets moving about in a circular channel below a horizontal wheel by which they are actuated. The channel at one side descends to a cavity, into which the water flows, and then rises to the place of exit for the water. The buckets are contrived so as to be raised off the bottom of the channel immediately after passing the exit, and lodged on the wheel, to be carried thereby without friction until they return to the point where they take the water again, when they are tripped and let fall again to the bottom of the channel. The machine is designed to afford a simple and cheap means of raising water short distances for irrigation, drainage, and the like.

Improved Parlor Cooking Stove.

E. Mortimer Deey, New York city.—This invention relates to improvements in parlor cooking stoves of the kind for which a patent was granted to same inventor July 16, 1872, being a fire grate with a top, which may be used for cooking, and may be converted into a self-feeding top, and a couple of ovens behind the grate, one being above another. The back plate rests on the front edge of the bed plate, and has corrugations in its front face which correspond with passages through the bed plate, over which is a register to open or close them at will, for causing the draft to pass down through the fire grate or through the back, as may be required. The upper oven may be readily removed for the application of a false top plate with pot holes in it for use in supporting cooking pots and the like. A pot hole in the top, and under the removable top, is fitted in a circumscribing groove for preventing the escape of gas.

Improved Device for Suspending Pictures.

Charles Mason, New York city, assignor to Carl Most, Greenville, N. J.—This invention consists of a suspension cord, which is passed through the side staples of the picture frame, and then through a hollow tapering socket to a tapering key with central and side perforations and grooved or ribbed surface. The ends of the cord are drawn through the central and side perforations of the key, and formed in a knot below, to be easily adjusted by drawing back the key, being then firmly locked in position in the socket.

Improved Picket Fence.

Robert H. McGlaty, Moulton, Tex.—This is an improvement on the fence for which the same inventor obtained letters patent dated October 14, 1873. The posts are connected and supported at their top ends by wires. At certain distances are placed bracing posts in pairs, having their lower ends spread apart and their upper ends beveled and brought together, and fastened by bolts. The supporting wires connect with these bracing posts. Short stakes are driven into the ground, from which stay wires extend and connect with the bracing posts. The supporting wires cross each other between each two of the posts.

Improved Corn and Feed Mill.

Lauritz Meland, Iowa Falls, Iowa.—This mill is intended merely for grinding corn and feed, and is adapted to be driven by horse power. The operation is as follows: The grain is first cracked as it falls between cylinders at one end, and is carried against a blade and then pulverized between the cylinders and case, while, at the same time, it is gradually transferred to the discharge openings at the upper and lower sides of the chamber containing the cylinders. The latter have corresponding acute-angled spiral furrows and edges, and the blade projects up intermediately nearly or about to their middle.

Improved Crank.

William Henry Phillips, Bridgeton, N. J.—The end of this shaft is made to receive a round crank and a square crank. The crank is made in two parts. One part is fitted to the round portion of the shaft, and the other part is made open, so as to fit on and enclose three sides of the square portion. The open part will readily slide on the other portion sufficiently far to detach the open end from the square of the shaft. The motion of the open part is limited by a mortise and pin. The crank handle is also in two sections, one attached to one part and the other to the other, each being a semicircle, and forming an entire round handle when the shaft is being turned for elevating. There may be a spring to force the two parts from each other when they are not grasped by the hand. This crank may be used in perfect safety, as no serious accident can happen should the handle slip from the hand in elevating.

Improved Vehicle Spring.

Milton Newell, San Francisco, Cal.—This consists of the carriage body jointed at each end to arms of a transverse rockshaft, and also connected by a spring with an arm of the rockshaft at the opposite end in such a manner that the revolving action of the weight of the body on the rockshaft is opposed by the springs. An easy up-and-down motion is thus produced without any forward and backward or side motion whatever, and the apparatus employed is all of a simple and cheap character.

Improved Seed and Grain Drill.

Asa Canterbury, Gibson City, Ill.—In this seeder, there are sharp, deeply furrowing wheels and curved spouts to drill the grain, reversely curved spouts to drill the grass seed on the nearly filled furrow, and small blunt wheels that press the pulverized soil to and shallowly over the grass seed.

Improved Machine for Bending Bolster Stake Irons.

Bernhard Jensen and Nicholas Huetter, Kenosha, Wis.—This is a machine for bending bolster stake irons in cold state, for farm, lumber, and other wagons. It consists mainly in the arrangement of a strong swinging lever with obliquely slotted end, and a bending roller pivoted to the main supporting block, which is firmly set into a vise. An adjustable main roller for bending (in connection with the lever end and a curved guide frame with side extending curved supporting part) the bolster stake irons by the different operations of the machine.

NEW BOOKS AND PUBLICATIONS.

A MANUAL OF METALLURGY. By William Henry Greenwood, Associate of the Royal School of Mines, England, F. C. S., etc. Volume I., containing Fuel, Iron, Steel, Tin, Antimony, Arsenic, Bismuth, and Platinum. Illustrated by Fifty-Nine Engravings. Price $1.50. New York: G. P. Putnam's Sons, Fourth avenue and 23d street.

The literature of metallurgy has long needed popularization, more on account of its diffuseness than its deficiency. Mr. Greenwood has succeeded, in the treatise before us, in condensing the labors of many writers more or less precise and authentic, into a handy book of reference, containing well digested information and trustworthy formulæ. The work is especially adapted for students, for whom it is intended, being Volume I. of No. 19 of Messrs. Putnams' Advanced Science Series.

THE INTERNATIONAL REVIEW. Published Six Times a Year. Volume I., No. 6. Annual Subscription, $5. New York: A. S. Barnes & Co.

We are pleased to observe that this serial maintains its uniform excellence. The issue now before us contains a thoughtful and original essay by Philip Gilbert Hamerton, a rising star in critical literature, as well as an exhaustive treatise on the iron resources of the United States by Professor J. S. Newberry, which we commend to the perusal of manufacturers and statisticians.

SURVEY OF THE WEST OF THE HUNDREDTH MERIDIAN. Report upon the Ornithological Specimens collected in 1871, 1872, and 1873. Catalogue of Plants collected in 1871, 1872, and 1873. Washington, D. C.: Government Printing Office.

THE HEATHENS OF THE HEATH, a Romance, Instructive, Absorbing, Thrilling. By William McDonnell, Author of "Exeter Hall." Price, in paper, $1; in cloth, $1.50. New York: D. M. Bennett, 335 Broadway.

EULOGY ON CHIEF JUSTICE CHASE, delivered by W. M. Evarts, before the Alumni of Dartmouth College, N. H. Price 25 cents. Hanover, N. H.: J. B. Parker.

ANNUAIRE DE L'UNIVERSITE LAVAL, POUR L'ANNEE 1874–75. Quebec, Canada: A. Coté et Cie.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From September 30 to October 15, 1874, inclusive.

BOILER WATER INDICATOR.—J. E. Watson, Louisville, Ky.
CLEANING SUGAR, ETC.—J. O. Donner, New York city.
CRUSHER, ETC.—T. A. Weston (of Philadelphia, Pa.), Birmingham, England.
FLOOR CLOTH FABRIC.—H. B. Meech (of New York city), London, England.
JOURNAL BEARING.—C. A. Hussey, New York city.
LAMP.—I. R. Forbes, New Orleans, La.
LOOM.—C. H. Chapman, Shirley, Mass.
LOOM.—L. J. Knowles, Mass.
LUBRICATING JOURNAL BOX.—C. T. Pierson, Ramapo, N. Y.
MAKING OXYGEN, HYDROGEN, ETC.—N. H. Edgerton, Philadelphia, Pa.
MUCILAGE BRUSH.—C. A. Hussey, New York city.
PENCIL CASES, ETC.—A. T. Cross, Providence, R. I.
PRINTING MACHINERY.—R. M. Hoe, New York city.
SEWING MACHINE EMBROIDERER.—R. M. Rose, Williamsburgh, N. Y.
STEAM PUMP, ETC.—E. Cope *et al.*, Hamilton, Ohio.
STEAM REGULATING VALVE.—J. E. Watts, Lawrence, Mass.
VARIABLE EXHAUST FOR ENGINES.—O. Stewart, East Cambridge, Mass.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Answers to Correspondents

A. R. can copper iron castings by the process described on p. 155, vol. 26 —F. C. M. will find a recipe for black ink on p. 203, vol. 26, and for copying ink on p. 59, vol. 25.—G. S. will find directions for making wax into sheets for flower making on p 50, vol. 30.—W. P. can brown gun barrels by the method described on p. 286, vol. 26.—T. W. W. will find details of a process for steelifying or case-hardening iron on p. 281, vol. 27.

(1) H. L. B. asks: Does the locust, that comes every seventeen years in Pennsylvania, come in the same year all over the world? A. No.

(2) C. D. W. asks: How can I make chloride of copper? A. Chloride of copper ($Cu Cl$) may be obtained by the spontaneous combustion of copper in chlorine gas; but it is more advantageously prepared by dissolving the oxide or carbonate in hydrochloric acid, when, on evaporation, it crystalizes in green needles. A concentrated solution of chloride of copper is of a green color, but it becomes blue on dilution; and when the salt is anhydrous, it is liver-colored.

(3) J. Y. asks: What is meant by a microscope which magnifies 10,000 times? How large would a human hair appear under this power? A. Human hair varies considerably in different persons. An ordinary specimen magnified 100 diameters, or 10,000 times in surface, would seem ¼ of an inch in diameter. If magnified 10,000 diameters, it would appear 2 feet in diameter, which no microscope now made could cover. 2. How large would a man appear through a spyglass whose power is 25 times, at a distance of 15 miles? A. As large as he would appear at a distance of ⅗ mile.

(4) J. H. asks: How can I keep protosulphate of iron from oxidizing? I keep it corked, but this is no use. A. Place the protosulphate in a large glass bottle, fit a cork very tightly and seal up with paraffin or sealing wax. In this manner, large quantities are kept in a perfect condition.

Does the light injure canned fruit? A. In some instances it may be injurious. Upon some canned fruits, light does undoubtedly produce slight chemical changes.

1. Would tallow at 8 cents per lb. be a cheap article to make soap with, or would "cracklings" at 4 cents per lb. be cheaper? A. We should think that tallow at 8 cents would be preferable. 2. Please give me a recipe for making hard soap with tallow. A. Take freshly slacked lime, sal soda, and tallow, of each 2 lbs.; dissolve the soda in 1 gallon boiling soft water; now mix in the lime, stirring occasionally for a few hours; after which let it settle, pouring off the clear liquor and boiling the tallow therein until it is all dissolved. Cool it in a flat box or pan, and cut into bars or cakes. It can be scented with sassafras oil by stirring the oil in when the soap is cooling. When any form of soda is used in making soap, it is necessary to use lime to give it causticity, which gives it much greater power upon the grease, by removing the carbonic acid; hence the benefit of putting lime in the bottom of a leach when making soap from common ashes.

(5) A. W. R. asks: How can I get rid of dandruff in hair? A. The most results follow the use of warm baths, taken daily and prolonged for an hour or more, and the subsequent inunction with a soothing and sheathing pomade, such as that of the benzoated ointment of oxide of zinc.

Is there a cure for bunions? A. "When the *bursa* which lies toward the plantar surface of the metatarsal bone of the great toe becomes enlarged, or when a new serous sac is formed upon the inner and posterior aspect of this bone, the disease termed a bunion occurs. In this affection, the enlargement of the *bursa* is usually secondary to an alteration in the shape and position of the great toe, which, in consequence of the pressure of narrow-pointed boots, has been thrown outwards in an oblique direction (that is, towards the little toe), so as to lie over or under some of the contiguous digits; in this way a sharp angle is formed at the junction between the first phalanx and the metatarsal bone of the great toe. This angle, being constantly pressed upon by the boot, becomes irritated, and, for its protection, the *bursa* that is there naturally situated becomes enlarged, or an adventitious one forms. From time to time the *bursa* and the projecting angle become irritated and inflamed, and the morbid action there set up may run to suppuration of a very troublesome kind, a thin, unhealthy pus being formed, which is discharged through an opening that speedily becomes fistulous, and may degenerate into a most troublesome indolent sore. *Treatment:* In the treatment of this affection, the first thing to be done is to change the direction of the toe by wearing properly shaped boots, made with the inner side of the sole straight from the toe to the heel. If accidental inflammation be excited in the part, it must be allayed by the application of leeches, warm foot baths, and poulticing; the cutaneous irritation that is left may best be removed by painting the surface with a strong solution of nitrate of silver. The faulty direction of the toe may best be remedied by using an ingenious contrivance, the action of which consists in drawing the inverted end of the toe inwards by the constant action of a slender steel spring."—*Erichsen.* Should these means fail, consult a surgeon.

What will remove flesh worms? A. The flesh worm (*acarus folliculorum*) is supposed to be caused by a deficiency of expulsory power in the follicles and ducts of the sebiparious glands, by condensation of the secretion, which renders the expulsory power nugatory. For treatment, see p. 251, vol. 31.

(6) G. E. W. asks: Are there minute insects in the human blood? A. When the blood is in a normal condition, there are no parasites present; but they are found in some cases if it be diseased.

(7) S. M. asks: What is a good method of whitening *ferns*? A. By exposing them for a short time to the action of sulphurous acid gas, obtained by burning a little sulphur.

Is there anything that will remove moles from the skin? A. "They are easily removed by the knife, care being taken to direct the incisions in the line of the ordinary folds of the skin. Better perhaps is *potassa fusa* a point of which is introduced in the center of the *nævus*; it diffuses itself through the areolar mass, the disorganized tissue dries up in a scab, and falls off in ten or fourteen days, leaving very little trace of its existence. This method of treatment is applicable to *nævi* (or moles) of small size only. When of considerable extent, they are beyond the control either of knife or caustic."—*Wilson.*

(8) B. E. D. asks: What ingredients are used to set the colors in muslins, calicoes, etc., making them proof against water? I wish to make colors on papers, such as marbled papers, waterproof. A. Insoluble colors are obtained by taking advantage of known chemical changes; thus chromate of lead (chrome yellow) is precipitated by dipping the stuff into solutions, first of acetate of lead, and then into bichromate of potassa. Mordants are bodies which, by their attraction for organic matter, adhere to the fiber of the stuff, and also to the coloring matter. They are applied first, but in domestic dyeing they are often mixed with the dyestuff. By the use of a mordant, a dye which would otherwise wash out is rendered permanent. Some mordants modify the color; thus alum brightens madder, giving a light red, while iron darkens it, giving a purple. The principal mordants are alum, cubic alum, acetate of alumina, protochloride of tin, bichloride of tin, sulphate of iron, tannin, and stannate of soda.

(9) C. A. B. & Co. ask: How can we make explosive picrate salts, particularly those of lead? A. We can find no mention of any of these salts (except that of potassa) being used as explosives.

(10) D. F. J. asks: 1. How can I make paper adhere to whitewashed walls? A. The usual and perhaps the best method is that of removing as much of the whitewash as possible by scraping, and moistening the wall with water before applying the paper (previously coated with the paste). 2. What is the best method of removing old wall paper to prepare for new? A. Moisten the paper with water for a short time, when it can be removed without difficulty.

(11) W. R. asks: What is the weight in ounces of the largest diamond? A. The largest known diamond formerly belonged to the Great Mogul, and when found weighed 2769·3 grains, or nearly six ounces; it had the form of half a hen's egg.

(12) W. L. P. asks: What are the constituents of natural phosphate of lime? A. The composition varies much. That obtained from Snarum, Norway, contained phosphoric acid 41·54, sesquioxide of iron 1·79, calcic oxide 53·46, and chlorine 2·66, per cent. That from the Ural Mountains contained phosphoric acid 41·99, calcic oxide 55·95, chlorine 0·01, and fluorine 4·20 per cent. The phosphatic limestone found in this country would contain nearly the same as the above; certainly it would not vary much in the amount of phosphoric acid. It is found in Maine, New Hampshire, New York, New Jersey, Pennsylvania, Maryland, and Delaware. A shaft has been sunk near Hurdtown, N J., and the phosphate of lime (apatite) mined.

(13) G. F. F. asks: With what preparation can I color white ivory chessmen red? A. They may be stained with the ordinary dyeing materials. The ivory should first be steeped in a solution of bichloride of tin as a mordant, and then in a hot bath of Brazil wood or cochineal.

What will remove oil from paper? A. Scrape finely some pipe clay (the quantity will be easily determined on making the experiment); on this lay the sheet or leaf, and cover the spot, in like manner, with the clay Cover the whole with a sheet of paper, and apply for a few seconds a heated iron box, or any substitute adopted by laundresses. On using india rubber to remove the dust taken up by the grease, the paper will be found restored to its original whiteness and opacity. This simple method has proved much more effectual than the use of turpentine.

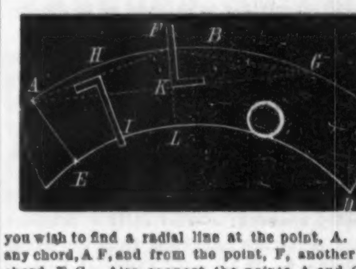
(14) C. H. C. asks: 1. Has there ever been manufactured a glass that will stand a red heat and not melt? A. No. 2. Is there any substance that can be put into glass to render it flexible? A. Nothing, to our present knowledge, accomplishes this, although this (supposed) lost art has been much sought after.

(15) H. J. asks: 1. Will three boilers, each 24 inches long by 7 inches diameter, supply enough steam to run a 3x6 engine, carrying 60 lbs. pressure and making 200 revolutions per minute? A. They would be rather too small. 2. How heavy and how large should the flywheel of an engine of the above size be? A. Diameter 15 inches, weight from 70 to 80 lbs. 3. What pressure would boilers of the above size stand? They are made of 1-16 steel. A. About 90 lbs. per square inch.

(16) A. F. asks: Can any musician inform me how a cornet can be blown completely out of tone? A. It can be done by hard blowing.

(17) R. R. S. says: 1. I use a tin cup to make my tea in. I put cold water into the cup with the tea and set it on to the stove to steep. The cup keeps smooth and bright, but has the tea stain upon its surface. I use this cup very often to boil water in, and it keeps smooth and free from scale. If I use another cup to boil water in, it will become covered with scale in three or four heatings, visible to the sight and perceptible to the sense of feeling. What is the cause of this phenomenon? A. The water undoubtedly contains a large amount of lime, magnesia, soda, etc., in solution. Upon boiling, these would be precipitated and form the scales you speak of. But the presence of tea has a different effect. Tea contains tannin and other substances which exert, doubtless, an influence upon the solubility of the alkalies. In most cases they are very soluble, but, if an excess of the bases be present, rapidly attract oxygen and become brown by the destruction of the gallo-tannic acid. 2. Would not a decoction of tea prevent the formation of scale in steam boilers, if it was applied while they were new, and also on the surface of tea kettles? A. There is a preparation in market, tannate of soda, used for this purpose, which probably acts in a similar manner. The decoction of tea would be too expensive.

(18) J. A. M. asks: What is the quickest method of finding the distance between two circles as A E, without the aid of the radius or diameter of either circle, by the application of the square, on the outside line A C, or the inside line E D? A. Suppose that A B C D E represents material to be cut, and



you wish to find a radial line at the point, A. Draw any chord, A F, and from the point, F, another equal chord, F G. Also connect the points A and G by a straight line. Place a square on the chord, A F, and draw a perpendicular line, H I, at the middle point of this chord. Then place the square upon the line, A G and draw a perpendicular, F K, through the point, F continuing it to L. Make I E equal to I L, and draw the line A E, which will be the direction in which to make the cut. The same construction can be used for finding the direction of the cut at the other end.

(19) Z. S. says: I should like to try Siemens' process of silvering glass, described in *Science Record* for 1874, pp. 64, 96. How is acetic aldehyde made, and how is dry ammoniacal gas made and passed through it? A. Aldehyde may be obtained by the gradual oxidation of alcohol in various ways. It is formed when the vapor of alcohol mixed with air is transmitted through a porcelain tube heated to low redness, or when alcohol is acted upon by dilute nitric or chromic acid; owing to the effects of nitric acid upon the elements of alcohol, it is produced during the preparation of the fulminates of silver and mercury, and it is always present in nitrous ether; it may also be procured from the dry distillation of lactic acid, or lactate of copper. Aldehyde is, however, usually procured by Liebig's method of distilling, in a capacious retort, a mixture of 6 parts of sulphuric acid, 4 parts of alcohol (specific gravity 0·850), 4 of water, and 6 of finely powdered black oxide of manganese. The product, being very volatile, must be condensed in vessels cooled with ice, and the process must be stopped when the distillate becomes acid. Since, however, it is in a very dilute and impure condition, it is to be rectified from an equal weight of chloride of calcium, in order to free it from alcohol and water. This operation is repeated twice, or even three times. Take equal parts of quicklime and chloride of ammonium (sal ammoniac) separately powdered, and intimately mix; transfer to a retort and gently heat. Abundance of pure ammonia, as a transparent, colorless gas, will be given off. It should be passed through a tube containing recently prepared quicklime. The gas is allowed to pass through the liquid in the usual way, which must be kept cool with ice. Prismatic needles of snowy whiteness are thus formed, which is the compound of ammonia and aldehyde required.

(20) D. W. B. asks: 1. How can I make alcohol without distillation? A. We cannot tell you.

There is a quality of iron or iron salt not attracted by the magnet; it is called allotropic, and is soluble in water. How is it made? A. There is no known oxide or form of iron that has the properties you state.

How can oleic acid be made? A. The isolation of this acid in a state of purity is a matter of some difficulty. In order to obtain the pure acid, Varrentrapp recommends that almond oil be saponified with potassa or with soda, and that the soap be decomposed with hydrochloric acid. The mixed fatty acids are then to be digested with half their weight of finely powdered oxide of lead. On digesting the mixed salts of lead with twice their volume of ether for 24 hours, the oleate of lead is dissolved and separated from the other salts. The etherial solution is to be mixed with dilute hydrochloric acid, which decomposes the oleate The oily acid is dissolved by the ether and rises to the surface The ether is to be expelled by heat.

How can oil of brick be made? A. Oil of brick is made by saturating fragments of brick with oil, and distilling at a red heat.

Can pyro-acetic spirit be made without distillation? A. No.

Where can red resin be obtained? A. Ask any druggist or dealer in varnishes for it. As to the difficulty of dissolving rubber in ether, see p. 251, vol. 31.

(21) L. K. L. says, in reply to F. H. B.'s question as to which vessel has made the fastest time across the ocean: The Inman steamer City of Brussels left Sandy Hook at 9.15 on the morning of December 4 1869, and dropped anchor in Queenstown harbor after a run of 7 days, 20 hours, 22 minutes. She has since (June 1872) crossed in 7 days, 15 hours, 55 minutes. The Adriatic's best time, May, 1872, was between Queenstown and Sandy Hook 7 days, 18 hours, and 55 minutes.

(22) N. A. K. says, in reply to J. C.'s query as to size of sail for a boat: I think he could have a larger sail on his boat than you recommend. I have a boat 12 feet long, 3 feet wide, and 1 foot deep. She is pointed at the bows, and made of pine boards, ⅜ inch thick, bent dry, without sawing. Her keel is 6 inches wide, hinged so that it will lay flat to the boat when released from an upright position. Her sail is 8 feet on the mast, 9 feet from the end of the boom to the gaff boom is 11 feet and gaff 7 feet. The boat will carry persons, and is perfectly safe.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Letter from Faraday. By H. W. C.
On Alcohol. By J. D. P.
On a Miniature Locomotive. By F. S.
On some Special Tools. By W. P. P.
On Diamonds. By G. H. W.
On the Potato Bug. By J. J. S.
On Demoniacal Possession. By W. S. H.

Also enquiries and answers from the following:

B.—D. E. J.—J. R.—P.—W. J. McG.—F. S. R.—A. K.—W. N. H.—F. S. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc. will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells a composition for removing ink stains from the hands and clothes? Who sells artificial butter? Who sells Martini-Henry rifles?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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October 20, 1874,

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Shutter fastener, E. F. Baldwin	156,010
Sign, illuminated, J. Harrison (r)	6,093
Skirt, O. P. Flynt	156,019
Sofa, Schabel & Schulz	156,177
Spikes, making grooved, J. H. Swett	156,186
Stove, E. Smith, (r)	6,091
Stove, coal oil, J. A. Frey	156,149
Stoves, air flue for, J. F. Langlais	156 092
Sugar, draining and filtering, S. S. Hepworth	156,058
Suspenders, Hall & Lasher	156,083
Swift, J. Chase	156,135
Table, E. M. Bement	156,120
Table, ironing, F. Harvey	156,084
Thrashing machine reel, G. C. Dodge	156,076
Time detector, watchmen's, A. Meyer	156,098
Tool handle, A. W. Scott	156,179
Trellis, grape vine, J. McDonald	156,097
Truss, B. A. Washburn	156,050
Turbine wheel, J. L. Rodgers	156,102
Valve, pressure reducing, J. Jonson	156,165
Valve, slide, F. F. Landis	156,026
Vat, fermenting, J. C. G. Hüpfel	156,089
Vehicle running gear, B. W. Chase	156,134
Ventilating illuminating tiles, W. Lynch	156,060
Ventilator, J. C. Bates	156 011
Vessels, spring traveler for, S. Poole	156,039
Vise, E. Schlenker	156 066
Vise jaw, detachable, B. F. Stephens	156,105
Wagon, hay, J. H. Anderson	156,115
Wagon jack, A. Whitcomb	156,110
Wagon spring, J. M. Vanderzee	156,071
Wagon tongue support, J. Oehler	156,099
Washing machine, G. D. Berdan	156,121
Washing machine, G. W. Holmes	156,157
Washing machine, boiler, J. Harris	156,156
Watch key, J. S. Birch	156,124
Watch regulator, C. Teske	156,046
Windmill, W. H. Wheeler	156,195
Window blind, R. H. Dickinson	156 016
Wringing machine, F. Way	156,191

APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

31,147.—STEAMBOAT STAGING.—A. J. Bell. January 6.
31,153.—NEEDLE.—G. Cooper. January 6.
31,172.—PLOWS.—W. Jarrell. January 6.
31,182.—WOOD-BENDING MACHINE.—H. McDonald Jan. 6.
31,199.—CURRY COMB.—S. J. Wheeler. January 6.
31,203.—SEWING MACHINE.—F. D. Ballou. January 6.
31,214.—SEWING MACHINE.—Q. Rice. January 6.

EXTENSIONS GRANTED.

30,450.—RUBBER CAR SPRING.—T. F. Allyn.
30,451.—CLOTHES SQUEEZER.—F. Arnold.
30,458.—CAR WHEEL.—G. S. Bosworth.
30,480.—PUMP.—W. J. Johnson.
30,515.—CAR SEAT AND COUCH.—F. Burke.

DESIGNS PATENTED.

7,804.—HORSE BLANKET FABRIC.—G. R. Ayres, Phil., Pa.
7,805.—TYPE.—T. W. Smith, London, England.

TRADE MARKS REGISTERED.

2,028.—SALTS.—Salts Manuf. Co., Crab Orchard, Ky.
2,029.—PERFUMES.—Fisher & Co., New York city.
2,030.—FLOUR.—Heissenbuttel et al., Brooklyn, N.Y.
2,031.—MEDICAL SIRUP.—J. J. Lawrence, Wilson, N. C.
2,032.—FERTILIZERS.—E. Whitman et al., Baltimore, Md.
2,033.—COTTON GOODS.—Joy & Co., Passaic, N. J.
2,034.—EMERY WHEELS.—Lehigh E.W.Co., Weissport, Pa.
2,035.—TEAS.—A. Man & Co., San Francisco, Cal.
2,036.—SHEETINGS.—Naumkeag Cotton Co., Salem, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, OCTOBER 22 to 29, 1874.

3,969.—J. L. O. Vidal, Parish of St. Louis of Lotbinière, Lotbinière county, P. Q. Extension of No. 109. "Charrue avec oreille à base élargie à meme, ou rapportée." (Improvements in plows.) Oct. 22, 1874.

3,970.—William Muir, Montreal, P.Q. Extension of No. 94, called "Muir's Improved Multiple Sewing Machine." Oct. 24, 1874.

3,971.—R. W. Soper, London, Middlesex county, Ont. Improvement on breech-loading rifles and shot guns, called "Soper's Improved Breech Loading Rifles and Shot Guns." Oct. 26, 1874.

3,972.—J. G. Scott, St. Thomas, Montmagny county, P.Q. Improvements on car-coupling apparatus, called "Scott's Safety Car Coupler." Oct. 26, 1874.

3,973.—William H. Collins, Whitby, Ontario county, P.Q. Improvements in stone pipe couplers, called "Collins' Stone Pipe Coupler." Oct. 26, 1874.

3,974.—William B. True, Silver Islet, Ont. Improvements in a machine for washing or separating the heavier ores or metals, called "True's Improved Vanning Machine." Oct. 26, 1874.

3,975.—I. W. Neads, Toronto, Ont. Improvements on boring bars, called "Nead's Improved Boring Bar." Oct. 26, 1874.

3,976.—J. Nassian, Strazsa, Hungary, Austria. Improvements in the manufacture of rock candy, called "Nassian's Process of Making Rock Candy." Oct. 26, 1874.

3,977.—J. Nassian, Strazsa, Hungary, Austrria. Improvements on the process of clarifying sugar, called "Nassian's Process of Clarifying Sugar." Oct. 26, 1874.

3,978.—William Tucker, Tiskedale, Worcester county, Mass., U. S. Improvements on apparatus for dropping the cuts of augers and auger bits, called "Tucker's Apparatus for Dropping Cuts of Augers and Auger Bits." Oct. 26, 1874.

3,979.—L. F. Baily, Maitland, Hants county, Nova Scotia. Improvements on potato diggers, called "Bailey's Potato Digger." Oct. 26, 1874.

3,980.—J. W. Hanmore, Newburgh, Orange county, N.Y., U. S. Improvements in jacketing of steam boilers, etc., called "Hanmore's Patent Combination Non-Conducting Jacketing." Oct. 26, 1874.

3,981.—J. Plummer, London, Middlesex county, Ont. Improvements on spoke lathes using three centers, called "Plummer's Improvement on Spoke Lathes Using Three Centers." Oct. 26, 1874.

3,982.—G. J. Wardwell, Rutland, Rutland county, Vt., U. S. Improvements in oscillating steam engines, called "Wardwell's Oscillating Steam Engine." Oct. 26, 1874.

3,983.—C. V. Michell, Pickering Township, Ontario county, Ont. Improvements in machinery for the purpose of unloading roots, etc., from the wagon or other carriage when hauled therein, called "Michell's Self Root Unloader." Oct. 26, 1874.

3,984.—L. A. Dessaulles, Montreal, P. Q., assignee of H. H. d'Abrigeon. Améliorations dans les appareils à équilibrer les meules de moulin, dits "Appareil d'Abrigeon pour Equilibrer les Meules de Moulin." (Improvements on apparatus for equilibrating millstones." Oct 28, 1874.

3,985.—J. G. Scott, St. Thomas, Montmagny county, P.Q. Improvements in car brake couplers, called "Scott's Car Brake Self-Acting Coupler." Oct. 28, 1874.

3,986.—D. L. Newcomb, Kenton, Hardin county, O., U.S. Improvements on augers, shaft coupling, tube-lining setters, and derricks for boring wells, called "Newcomb's Well Boring Apparatus." Oct. 28, 1874.

3,987.—J. H. Cowherd and F. Cowherd, Brantford, Brant county, Ont. Improvement on eaves trough and machines for making the same, called "Cowherd's Combined Eaves Trough Machine." Oct. 28, 1874.

3,988.—C. Kinney, Denham township, Oxford county, Ont. Improvements on sash holders and fasteners, called "Kinney's Improved Automatic Sash Holder and Fastener." Oct 28, 1874.

3,989.—E. E. Everitt, Philadelphia, U. S., and W. S. Haywood, Rochester, Monroe county, N. Y., U. S. Improvements on bedsteads, called "Everitt's Parlor Bedstead." Oct. 28, 1874.

3,990.—J. Munson, Collingwood, Simcoe county, Ont. Extension of No. 113, called "Munson's Dominion Bee Hive." Oct. 29, 1874.

3,991.—J. Call and J. T. Robinson, Richmond, Sogadahoe county, Me., U. S. Improvements on center boards for vessels, called "Call's Flanged Center Board." Oct. 29, 1854.

3,992.—Wm. Tucker, Tiskedale, Worcester county, Mass., U. S. Improvements on saw gummers, called "Tucker's Improved Saw Gummer." Oct. 29, 1874.

3,993.—Wm. Tucker, Tiskedale, Worcester county, Mass., U. S. Improvements in machines for twisting augers and auger bits, called "Tucker's Machine for Twisting Augers and Auger Bits." Oct. 29, 1874.

3,994.—G. F. Godley, Philadelphia, U. S. Improvements on railroad car and other spiral springs, called "Godley's Improvement on Spiral Springs." Oct. 29, 1874.

3,995.—L. Crofoot, Pavilion, Genesee county, N. Y., U. S. Improvements on combined bag holders and trucks called "The American Bag Holder." Oct. 29, 1874.

3,996.—L. S. Chichester, New York city, U. S. Improvements in hulling, cooking, and preparing cereals for use, called "Chichester's Prepared Cereals." Oct. 29, 1874.

3,997.—G. J. Wardwell, Rutland, Rutland county, Vt. U. S. Improvements in reciprocating crosshead engines, called "Wardwell's Reciprocating Crosshead Engine." Oct. 29, 1874.

3,998.—A. Wilder, Augusta, Kennebec county, Me., U. S. Improvements in oilcloths, called "Wilder's Improved Oilcloth." Oct. 29, 1874.

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